

Final Report

VOLUME I

**FEASIBILITY STUDY FOR HVAC UPGRADE
FORT RILEY, KANSAS**

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

Prepared for

U.S. Army Corps of Engineers
Kansas City District
Kansas City, Missouri

Under

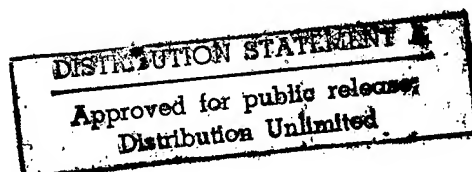
Contract No. DACA01-94-D-0033
Delivery Order 0005
EMC No. 1406-005

August 1995

19971016 234

By

E M C Engineers, Inc.
2750 S. Wadsworth, Suite C-200
Denver, Colorado 80227
303/988-2951



DTIC QUALITY INSPECTED 2

This report has been prepared at the request of the client, and the observations, conclusions, and recommendations contained herein constitute the opinions of E M C Engineers, Inc. In preparing this report, EMC has relied on some information supplied by the client, the client's employees, and others which we gratefully acknowledge. Because no warranties were given with this source of information, E M C Engineers, Inc. cannot make certification or give assurances except as explicitly defined in this report.



DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited.
Distribution A. Approved for public release.

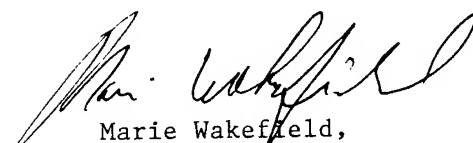

Marie Wakefield,
Librarian Engineering

TABLE OF CONTENTS

List of Tables.....	x
List of Abbreviations	xi
EXECUTIVE SUMMARY	ES-1
1. GENERAL DESCRIPTION.....	1-1
1.1 AUTHORITY FOR FEASIBILITY STUDY FOR HVAC UPGRADE STUDY	1-1
1.2 PURPOSE FOR FEASIBILITY STUDY FOR HVAC UPGRADE STUDY	1-1
1.3 SCOPE OF WORK.....	1-1
1.4 APPROACH.....	1-2
1.5 WORK REMAINING TO COMPLETE PROJECT.....	1-3
2. FACILITY DATA	2-1
2.1 GENERAL	2-1
2.2 BUILDINGS INCLUDED IN ANALYSIS.....	2-1
2.3 ENERGY SOURCES AND CONSUMPTION	2-10
2.3.1 <i>Electricity</i>	2-10
2.3.2 <i>Natural Gas</i>	2-11
3. FIELD SURVEY OF HVAC SYSTEMS	3-1
3.1 GENERAL	3-1
3.2 OVERVIEW OF FIELD SURVEY OBSERVATIONS	3-1
3.2.1 <i>Typical HVAC System Components for Repair</i>	3-1
3.2.2 <i>Typical HVAC Systems for Replacement</i>	3-2
4. DESCRIPTION AND ASSESSMENT OF HVAC SYSTEMS.....	4-1
4.1 BUILDING 200 (ADMINISTRATION GENERAL PURPOSE).....	4-1
4.1.1 <i>HVAC System Existing Conditions</i>	4-1
4.1.2 <i>HVAC System Components for Repair</i>	4-2
4.1.3 <i>Proposed HVAC System Replacement</i>	4-2
4.1.4 <i>Recommendations</i>	4-2
4.2 BUILDING 222 (ADMINISTRATION GENERAL PURPOSE).....	4-4
4.2.1 <i>HVAC System Existing Conditions</i>	4-4
4.2.2 <i>HVAC System Components for Repair</i>	4-4
4.2.3 <i>Proposed HVAC System Replacement</i>	4-5
4.2.4 <i>Recommendations</i>	4-6
4.3 BUILDING 302 (FINANCIAL ADMINISTRATION)	4-7
4.3.1 <i>HVAC System Existing Conditions</i>	4-7
4.3.2 <i>HVAC System Components for Repair</i>	4-7
4.3.3 <i>Proposed HVAC System Replacement</i>	4-8
4.3.4 <i>Recommendations</i>	4-8
4.4 BUILDING 313 (CIVIL PERSONNEL ADMINISTRATION).....	4-9
4.4.1 <i>HVAC System Existing Conditions</i>	4-9
4.4.2 <i>HVAC System Components for Repair</i>	4-9
4.4.3 <i>Proposed HVAC System Replacement</i>	4-9
4.4.4 <i>Recommendations</i>	4-9

4.5 BUILDING 500 (POST HEADQUARTERS).....	4-11
4.5.1 <u>HVAC System Existing Conditions</u>	4-11
4.5.2 <u>HVAC System Components for Repair</u>	4-11
4.5.3 <u>Proposed HVAC System Replacement</u>	4-11
4.5.4 <u>Recommendations</u>	4-11
4.6 BUILDING 509 (ADMINISTRATION GENERAL PURPOSE).....	4-13
4.6.1 <u>HVAC System Existing Conditions</u>	4-13
4.6.2 <u>HVAC System Components for Repair</u>	4-13
4.6.3 <u>Proposed HVAC System Replacement</u>	4-13
4.6.4 <u>Recommendations</u>	4-13
4.7 BUILDING 5000 (FIRE STATION).....	4-15
4.7.1 <u>HVAC System Existing Conditions</u>	4-15
4.7.2 <u>HVAC System Components for Repair</u>	4-15
4.7.3 <u>Proposed HVAC System Replacement</u>	4-16
4.7.4 <u>Recommendations</u>	4-18
4.8 BUILDING 7178 (VEHICLE MAINTENANCE ADMINISTRATION).....	4-19
4.8.1 <u>HVAC System Existing Conditions</u>	4-19
4.8.2 <u>HVAC System Components for Repair</u>	4-19
4.8.3 <u>Proposed HVAC System Replacement</u>	4-19
4.8.4 <u>Recommendations</u>	4-20
4.9 BUILDING 7636 (REGIMENTAL HEADQUARTERS).....	4-21
4.9.1 <u>HVAC System Existing Conditions</u>	4-21
4.9.2 <u>HVAC System Components for Repair</u>	4-21
4.9.3 <u>Proposed HVAC System Replacement</u>	4-22
4.9.4 <u>Recommendations</u>	4-22
4.10 BUILDING 8056 (DET DAY ROOM).....	4-23
4.10.1 <u>HVAC System Existing Conditions</u>	4-23
4.10.2 <u>HVAC System Components for Repair</u>	4-23
4.10.3 <u>Proposed HVAC System Replacement</u>	4-23
4.10.4 <u>Recommendations</u>	4-24
4.11 BUILDING 7243 (ADMINISTRATION AND SUPPLY).....	4-25
4.11.1 <u>HVAC System Existing Conditions</u>	4-25
4.11.2 <u>HVAC System Components for Repair</u>	4-26
4.11.3 <u>Proposed HVAC System Replacement</u>	4-26
4.11.4 <u>Recommendations</u>	4-27
4.12 BUILDING 7432 (ADMINISTRATION AND SUPPLY).....	4-29
4.12.1 <u>HVAC System Existing Conditions</u>	4-29
4.12.2 <u>HVAC System Components for Repair</u>	4-29
4.12.3 <u>Proposed HVAC System Replacement</u>	4-29
4.12.4 <u>Recommendations</u>	4-29
4.13 BUILDING 7602 (ADMINISTRATION AND SUPPLY).....	4-31
4.13.1 <u>HVAC System Existing Conditions</u>	4-31
4.13.2 <u>HVAC System Components for Repair</u>	4-31
4.13.3 <u>Proposed HVAC System Replacement</u>	4-32
4.13.4 <u>Recommendations</u>	4-33
4.14 BUILDING 7608 (ADMINISTRATION AND SUPPLY).....	4-35
4.14.1 <u>HVAC System Existing Conditions</u>	4-35
4.14.2 <u>HVAC System Components for Repair</u>	4-35
4.14.3 <u>Proposed HVAC System Replacement</u>	4-36
4.14.4 <u>Recommendations</u>	4-36
4.15 BUILDING 7652 (ADMINISTRATION AND SUPPLY).....	4-37
4.15.1 <u>HVAC System Existing Conditions</u>	4-37
4.15.2 <u>HVAC System Components for Repair</u>	4-37
4.15.3 <u>Proposed HVAC System Replacement</u>	4-38
4.15.4 <u>Recommendations</u>	4-38

4.16 BUILDING 7658 (ADMINISTRATION AND SUPPLY).....	4-39
4.16.1 <u>HVAC System Existing Conditions</u>	4-39
4.16.2 <u>HVAC System Components for Repair</u>	4-39
4.16.3 <u>Proposed HVAC System Replacement</u>	4-40
4.16.4 <u>Recommendations</u>	4-40
4.17 BUILDING 8021 (ADMINISTRATION AND SUPPLY).....	4-41
4.17.1 <u>HVAC System Existing Conditions</u>	4-41
4.17.2 <u>HVAC System Components for Repair</u>	4-41
4.17.3 <u>Proposed HVAC System Replacement</u>	4-41
4.17.4 <u>Recommendations</u>	4-42
4.18 BUILDING 8057 (ADMINISTRATION AND SUPPLY).....	4-43
4.18.1 <u>HVAC System Existing Conditions</u>	4-43
4.18.2 <u>HVAC System Components for Repair</u>	4-43
4.18.3 <u>Proposed HVAC System Replacement</u>	4-43
4.18.4 <u>Recommendations</u>	4-44
4.19 BUILDING 227 (ENLISTED BARRACKS W/AS).....	4-45
4.19.1 <u>HVAC System Existing Conditions</u>	4-45
4.19.2 <u>HVAC System Components for Repair</u>	4-46
4.19.3 <u>Proposed HVAC System Replacement</u>	4-46
4.19.4 <u>Recommendations</u>	4-47
4.20 BUILDING 402 (ENLISTED BARRACKS W/AS).....	4-48
4.20.1 <u>HVAC System Existing Conditions</u>	4-48
4.20.2 <u>HVAC System Components for Repair</u>	4-48
4.20.3 <u>Proposed HVAC System Replacement</u>	4-49
4.20.4 <u>Recommendations</u>	4-49
4.21 BUILDING 410 (ENLISTED BARRACKS W/AS).....	4-51
4.21.1 <u>HVAC System Existing Conditions</u>	4-51
4.21.2 <u>HVAC System Components for Repair</u>	4-51
4.21.3 <u>Proposed HVAC System Replacement</u>	4-52
4.21.4 <u>Recommendations</u>	4-52
4.22 BUILDING 540 (ENLISTED BARRACKS W/AS).....	4-53
4.22.1 <u>HVAC System Existing Conditions</u>	4-53
4.22.2 <u>HVAC System Components for Repair</u>	4-53
4.22.3 <u>Proposed HVAC System Replacement</u>	4-53
4.22.4 <u>Recommendations</u>	4-53
4.23 BUILDING 7404 (ENLISTED BARRACKS W/O DINING)	4-55
4.23.1 <u>HVAC System Existing Conditions</u>	4-55
4.23.2 <u>HVAC System Components for Repair</u>	4-55
4.23.3 <u>Proposed HVAC System Replacement</u>	4-56
4.23.4 <u>Recommendations</u>	4-57
4.24 BUILDING 7612 (ENLISTED BARRACKS W/O DINING)	4-59
4.24.1 <u>HVAC System Existing Conditions</u>	4-59
4.24.2 <u>HVAC System Components for Repair</u>	4-60
4.24.3 <u>Proposed HVAC System Replacement</u>	4-60
4.24.4 <u>Recommendations</u>	4-62
4.25 BUILDING 7614 (ENLISTED BARRACKS W/O DINING)	4-63
4.25.1 <u>HVAC System Existing Conditions</u>	4-63
4.25.2 <u>HVAC System Components for Repair</u>	4-64
4.25.3 <u>Proposed HVAC System Replacement</u>	4-64
4.25.4 <u>Recommendations</u>	4-65
4.26 BUILDING 7616 (ENLISTED BARRACKS W/O DINING)	4-67
4.26.1 <u>HVAC System Existing Conditions</u>	4-67
4.26.2 <u>HVAC System Components for Repair</u>	4-68
4.26.3 <u>Proposed HVAC System Replacement</u>	4-68
4.26.4 <u>Recommendations</u>	4-69

4.27 BUILDING 7810 (ENLISTED BARRACKS W/O DINING)	4-71
4.27.1 <u>HVAC System Existing Conditions</u>	4-71
4.27.2 <u>HVAC System Components for Repair</u>	4-72
4.27.3 <u>Proposed HVAC System Replacement</u>	4-72
4.27.4 <u>Recommendations</u>	4-73
4.28 BUILDING 7814 (ENLISTED BARRACKS W/O DINING)	4-75
4.28.1 <u>HVAC System Existing Conditions</u>	4-75
4.28.2 <u>HVAC System Components for Repair</u>	4-76
4.28.3 <u>Proposed HVAC System Replacement</u>	4-76
4.28.4 <u>Recommendations</u>	4-77
4.29 BUILDING 7050 (ENLISTED BARRACKS WITH DINING)	4-79
4.29.1 <u>HVAC System Existing Conditions</u>	4-79
4.29.2 <u>HVAC System Components for Repair</u>	4-80
4.29.3 <u>Proposed HVAC System Replacement</u>	4-80
4.29.4 <u>Recommendations</u>	4-80
4.30 BUILDING 7053 (ENLISTED BARRACKS W/O DINING)	4-81
4.30.1 <u>HVAC System Existing Conditions</u>	4-81
4.30.2 <u>HVAC System Components for Repair</u>	4-81
4.30.3 <u>Proposed HVAC System Replacement</u>	4-82
4.30.4 <u>Recommendations</u>	4-82
4.31 BUILDINGS 8002, 8012, 8038, 8042, AND 8052 (ENLISTED BARRACKS W/O DINING).....	4-83
4.31.1 <u>HVAC System Existing Conditions</u>	4-83
4.31.2 <u>HVAC System Components for Repair</u>	4-83
4.31.3 <u>Proposed HVAC System Replacement</u>	4-84
4.31.4 <u>Recommendations</u>	4-84
4.32 BUILDINGS 8014, 8040, 8048, AND 8050 (ENLISTED BARRACKS W/O DINING)	4-85
4.32.1 <u>HVAC System Existing Conditions</u>	4-85
4.32.2 <u>HVAC System Components for Repair</u>	4-85
4.32.3 <u>Proposed HVAC System Replacement</u>	4-86
4.32.4 <u>Recommendations</u>	4-86
4.33 BUILDING 7806 (BATTALION HEADQUARTERS).....	4-87
4.33.1 <u>HVAC System Existing Conditions</u>	4-87
4.33.2 <u>HVAC System Components for Repair</u>	4-87
4.33.3 <u>Proposed HVAC System Replacement</u>	4-87
4.33.4 <u>Recommendations</u>	4-89
4.34 BUILDING 8025 (BATTALION ADMINISTRATION AND CLASSROOMS)	4-91
4.34.1 <u>HVAC System Existing Conditions</u>	4-91
4.34.2 <u>HVAC System Components for Repair</u>	4-91
4.34.3 <u>Proposed HVAC System Replacement</u>	4-91
4.34.4 <u>Recommendations</u>	4-93
4.35 BUILDING 3 (POST CHAPEL)	4-95
4.35.1 <u>HVAC System Existing Conditions</u>	4-95
4.35.2 <u>HVAC System Components for Repair</u>	4-95
4.35.3 <u>Proposed HVAC System Replacement</u>	4-95
4.35.4 <u>Recommendations</u>	4-97
4.36 BUILDING 7086 (UNIT CHAPEL)	4-99
4.36.1 <u>HVAC System Existing Conditions</u>	4-99
4.36.2 <u>HVAC System Components for Repair</u>	4-99
4.36.3 <u>Proposed HVAC System Replacement</u>	4-99
4.36.4 <u>Recommendations</u>	4-101
4.37 BUILDING 602 (DENTAL CLINIC).....	4-103
4.37.1 <u>HVAC System Existing Conditions</u>	4-103
4.37.2 <u>HVAC System Components for Repair</u>	4-103
4.37.3 <u>Proposed HVAC System Replacement</u>	4-103
4.37.4 <u>Recommendations</u>	4-105

4.38 BUILDING 7665 (DENTAL CLINIC).....	4-107
4.38.1 <u>HVAC System Existing Conditions</u>	4-107
4.38.2 <u>HVAC System Components for Repair</u>	4-107
4.38.3 <u>Proposed HVAC System Replacement</u>	4-107
4.38.4 <u>Recommendations</u>	4-108
4.39 BUILDING 7670 (DENTAL CLINIC).....	4-109
4.39.1 <u>HVAC System Existing Conditions</u>	4-109
4.39.2 <u>HVAC System Components for Repair</u>	4-109
4.39.3 <u>Proposed HVAC System Replacement</u>	4-109
4.39.4 <u>Recommendations</u>	4-111
4.40 BUILDING 7245 (ENLISTED PERSONNEL DINING)	4-113
4.40.1 <u>HVAC System Existing Conditions</u>	4-113
4.40.2 <u>HVAC System Components for Repair</u>	4-114
4.40.3 <u>Proposed HVAC System Replacement</u>	4-114
4.40.4 <u>Evaluation of Dedicated Boilers for Service Water Heating</u>	4-116
4.40.5 <u>Recommendations</u>	4-119
4.41 BUILDING 7606 (ENLISTED PERSONNEL DINING)	4-121
4.41.1 <u>HVAC System Existing Conditions</u>	4-121
4.41.2 <u>HVAC System Components for Repair</u>	4-122
4.41.3 <u>Proposed HVAC System Replacement</u>	4-122
4.41.4 <u>Evaluation of Dedicated Boilers for Space Heating and Service Water Heating</u>	4-124
4.41.5 <u>Recommendations</u>	4-125
4.42 BUILDING 7654 (ENLISTED PERSONNEL DINING)	4-127
4.42.1 <u>HVAC System Existing Conditions</u>	4-127
4.42.2 <u>HVAC System Components for Repair</u>	4-128
4.42.3 <u>Proposed HVAC System Replacement</u>	4-128
4.42.4 <u>Evaluation of Dedicated Boilers for Space Heating and Service Water Heating</u>	4-130
4.42.5 <u>Recommendations</u>	4-131
4.43 BUILDING 7804 (ENLISTED PERSONNEL DINING)	4-133
4.43.1 <u>HVAC System Existing Conditions</u>	4-133
4.43.2 <u>HVAC System Components for Repair</u>	4-134
4.43.3 <u>Proposed HVAC System Replacement</u>	4-134
4.43.4 <u>Evaluation of Dedicated Boilers for Space Heating and Service Water Heating</u>	4-136
4.43.5 <u>Recommendations</u>	4-136
4.44 BUILDING 7856 (ENLISTED PERSONNEL DINING)	4-137
4.44.1 <u>HVAC System Existing Conditions</u>	4-137
4.44.2 <u>HVAC System Components for Repair</u>	4-138
4.44.3 <u>Proposed HVAC System Replacement</u>	4-138
4.44.4 <u>Evaluation of Dedicated Boilers for Space Heating and Service Water Heating</u>	4-140
4.44.5 <u>Recommendations</u>	4-141
4.45 BUILDING 723 (MAINTENANCE HANGER COMB).....	4-143
4.45.1 <u>HVAC System Existing Conditions</u>	4-143
4.45.2 <u>HVAC System Components for Repair</u>	4-143
4.45.3 <u>Proposed HVAC System Replacement</u>	4-144
4.45.4 <u>Recommendations</u>	4-144
4.46 BUILDING 727 (MAINTENANCE HANGER COMB).....	4-145
4.46.1 <u>HVAC System Existing Conditions</u>	4-145
4.46.2 <u>HVAC System Components for Repair</u>	4-146
4.46.3 <u>Proposed HVAC System Replacement</u>	4-146
4.46.4 <u>Recommendations</u>	4-147
4.47 BUILDING 741 (MAINTENANCE HANGER COMB).....	4-149
4.47.1 <u>HVAC System Existing Conditions</u>	4-149
4.47.2 <u>HVAC System Components for Repair</u>	4-149
4.47.3 <u>Proposed HVAC System Replacement</u>	4-150
4.47.4 <u>Recommendations</u>	4-151

4.48 BUILDING 820 (TACTICAL EQUIPMENT SHOP)	4-153
4.48.1 <u>HVAC System Existing Conditions</u>	4-153
4.48.2 <u>HVAC System Components for Repair</u>	4-154
4.48.3 <u>Proposed HVAC System Replacement</u>	4-154
4.48.4 <u>Recommendations</u>	4-155
4.49 BUILDING 1470 (AR VEHICLE MAINTENANCE SHOP).....	4-157
4.49.1 <u>HVAC System Existing Conditions</u>	4-157
4.49.2 <u>HVAC System Components for Repair</u>	4-158
4.49.3 <u>Proposed HVAC System Replacement</u>	4-158
4.49.4 <u>Recommendations</u>	4-158
4.50 BUILDING 7176 (VEHICLE MAINTENANCE SHOP)	4-159
4.50.1 <u>HVAC System Existing Conditions</u>	4-159
4.50.2 <u>HVAC System Components for Repair</u>	4-159
4.50.3 <u>Proposed HVAC System Replacement</u>	4-159
4.50.4 <u>Recommendations</u>	4-161
4.51 BUILDING 7920 (DS VEHICLE MAINTENANCE SHOP)	4-163
4.51.1 <u>HVAC System Existing Conditions</u>	4-163
4.51.2 <u>HVAC System Components for Repair</u>	4-164
4.51.3 <u>Proposed HVAC System Replacement</u>	4-164
4.51.4 <u>Recommendations</u>	4-164
4.52 BUILDING 8390 (TACTICAL EQUIPMENT SHOP)	4-165
4.52.1 <u>HVAC System Existing Conditions</u>	4-165
4.52.2 <u>HVAC System Components for Repair</u>	4-166
4.52.3 <u>Proposed HVAC System Replacement</u>	4-166
4.52.4 <u>Recommendations</u>	4-166
4.53 BUILDING 202 (PHYSICAL FITNESS CENTER)	4-167
4.53.1 <u>HVAC System Existing Conditions</u>	4-167
4.53.2 <u>HVAC System Components for Repair</u>	4-168
4.53.3 <u>Proposed HVAC System Replacement</u>	4-168
4.53.4 <u>Recommendations</u>	4-170
4.54 BUILDING 7485 (BOWLING ALLEY).....	4-171
4.54.1 <u>HVAC System Existing Conditions</u>	4-171
4.54.2 <u>HVAC System Components for Repair</u>	4-171
4.54.3 <u>Proposed HVAC System Replacement</u>	4-172
4.54.4 <u>Recommendations</u>	4-173
4.55 BUILDING 6914 (MAIN EXCHANGE).....	4-175
4.55.1 <u>HVAC System Existing Conditions</u>	4-175
4.55.2 <u>HVAC System Components for Repair</u>	4-176
4.55.3 <u>Proposed HVAC System Replacement</u>	4-176
4.55.4 <u>Recommendations</u>	4-177
4.56 BUILDING 6940 (INDOOR SWIMMING POOL).....	4-179
4.56.1 <u>HVAC System Existing Conditions</u>	4-179
4.56.2 <u>HVAC System Components for Repair</u>	4-179
4.56.3 <u>Proposed HVAC System Replacement</u>	4-180
4.56.4 <u>Recommendations</u>	4-181
4.57 BUILDING 8069 (INDOOR SWIMMING POOL AND GYMNASIUM).....	4-183
4.57.1 <u>HVAC System Existing Conditions</u>	4-183
4.57.2 <u>HVAC System Components for Repair</u>	4-184
4.57.3 <u>Proposed Dehumidification Heat Recovery Unit</u>	4-184
4.57.4 <u>Heat Recovery Unit</u>	4-186
4.57.5 <u>Recommendations</u>	4-187

4.58 BUILDING 722 (FLIGHT SIMULATOR)	4-189
4.58.1 <u>HVAC System Existing Conditions</u>	4-189
4.58.2 <u>HVAC System Components for Repair</u>	4-190
4.58.3 <u>Proposed HVAC System Replacement</u>	4-190
4.58.4 <u>Recommendations</u>	4-190
4.59 BUILDING 724 (FLIGHT SIMULATOR)	4-191
4.59.1 <u>HVAC System Existing Conditions</u>	4-191
4.59.2 <u>HVAC System Components for Repair</u>	4-191
4.59.3 <u>Proposed HVAC System Replacement</u>	4-192
4.59.4 <u>Recommendations</u>	4-192
4.60 BUILDING 7739 (MOVING TARGET SIMULATOR)	4-193
4.60.1 <u>HVAC System Existing Conditions</u>	4-193
4.60.2 <u>HVAC System Components for Repair</u>	4-193
4.60.3 <u>Proposed HVAC System Replacement</u>	4-194
4.60.4 <u>Recommendations</u>	4-195
4.61 BUILDING 6620 (COMMUNITY ACTIVITIES CENTER)	4-197
4.61.1 <u>HVAC System Existing Conditions</u>	4-197
4.61.2 <u>HVAC System Components for Repair</u>	4-198
4.61.3 <u>Proposed HVAC System Replacement</u>	4-198
4.61.4 <u>Recommendations</u>	4-201
4.62 BUILDING 7604 (GENERAL INSTRUCTION BUILDING)	4-203
4.62.1 <u>HVAC System Existing Conditions</u>	4-203
4.62.2 <u>HVAC System Components for Repair</u>	4-203
4.62.3 <u>Proposed HVAC System Replacement</u>	4-204
4.62.4 <u>Recommendations</u>	4-204
4.63 BUILDING 7656 (GENERAL INSTRUCTION BUILDING)	4-205
4.63.1 <u>HVAC System Existing Conditions</u>	4-205
4.63.2 <u>HVAC System Components for Repair</u>	4-205
4.63.3 <u>Proposed HVAC System Replacement</u>	4-205
4.63.4 <u>Recommendations</u>	4-206
5. SUMMARY OF HVAC UPGRADE	5-1
5.1 GENERAL	5-1
5.2 SUMMARY OF HVAC SYSTEM COMPONENTS FOR REPAIR	5-1
5.3 SUMMARY OF PROPOSED HVAC SYSTEM REPLACEMENTS	5-1
6. RECOMMENDATIONS	6-1
6.1 RECOMMENDATIONS FOR HVAC SYSTEM COMPONENTS FOR REPAIR	6-1
6.2 RECOMMENDATIONS FOR HVAC SYSTEM REPLACEMENTS	6-1
6.3 RECOMMENDED ENERGY RETROFIT PROJECTS FOR HVAC UPGRADE	6-6

APPENDICES

- A Scope of Work
- B Confirmation Notices and Correspondence
- C Cost Estimate for HVAC System Components for Repair
- D Proposed HVAC System Replacement Calculations
- E Computer Simulation Program

LIST OF TABLES

<i>Table ES-1. Recommended HVAC Components for Repair</i>	<i>ES-3</i>
<i>Table ES-2. Recommended HVAC System Replacements</i>	<i>ES-4</i>
<i>Table ES-3. Nonrecommended HVAC System Replacements</i>	<i>ES-6</i>
<i>Table ES-4. HVAC Energy Retrofit Projects Recommended for FEMP</i>	<i>ES-8</i>
<i>Table ES-6. Economic Summary for Energy Retrofit Projects</i>	<i>ES-10</i>
<i>Table 2-1. Buildings Selected for HVAC Upgrade Analysis</i>	<i>2-2</i>
<i>Table 2-2. Computer Model Buildings for UMCS Study</i>	<i>2-4</i>
<i>Table 2-3. Historical Data for Electrical Consumption</i>	<i>2-10</i>
<i>Table 5-1. Summary of HVAC Components for Repair</i>	<i>5-2</i>
<i>Table 5-2. Proposed HVAC Systems for Replacement</i>	<i>5-3</i>
<i>Table 5-3. Economic Summary for Proposed HVAC System Replacement</i>	<i>5-4</i>
<i>Table 6-1. Recommended HVAC Components for Repair</i>	<i>6-2</i>
<i>Table 6-2. Recommended HVAC System Replacements</i>	<i>6-3</i>
<i>Table 6-3. Nonrecommended HVAC System Replacements</i>	<i>6-5</i>
<i>Table 6-4. HVAC Energy Retrofit Projects Recommended for FEMP</i>	<i>6-6</i>
<i>Table 6-5. Economic Summary for Energy Retrofit Projects</i>	<i>6-8</i>

VOLUME II - FIELD SURVEY FORMS
(Under separate cover)

LIST OF ABBREVIATIONS

ACC	- air cooled condenser
ACCU	- air cooled condensing unit
AHU	- air handling unit
ANSI	- American National Standards Institute
ASCE	- American Society of Civil Engineers
BLR	- boiler
CDP	- condensate pump
CH	- chiller
CNW	- condenser water
CNWR	- condenser water return
CNWS	- condenser water supply
COE	- Corps of Engineers
CV	- converter
CW	- chilled water
CWP	- chilled water pump
CWR	- chilled water return
CWS	- chilled water supply
EZDOE	- Computer program used for calculating building hour energy use.
DD	- dual duct
DDC	- direct digital control
DHRW	- dehumidification heat recovery unit
DTW	- dual temperature water
DTWP	- dual temperature water pump
DX	- direct expansion
ECO	- Energy Conservation Opportunity
EMC	- E M C Engineers, Inc.
F	- fahrenheit
FC	- fan coil
ft	- foot, feet
ft ²	- square feet
gal	- gallons
gpm	- gallons per minute
hp	- horsepower
hr	- hour
HRU	- heat recovery unit
HW	- hot water
HWP	- hot water pump
HWR	- hot water return
HWS	- hot water supply
H&V	- heating and ventilating
IR	- infrared radiant
kW	- kilowatt, one thousand watts
kWh	- kilowatt-hours, one thousand watt-hours
lb/hr	- pounds per hour
LCCA	- life cycle cost analysis
MAU	- make-up air unit

MZ	- multizone
O&M	- operation and maintenance
OA	- outside air
psia	- pounds per square inch absolute
psig	- pounds per square inch gage
RA	- return air
RAD	- radiation heating system
RAF	- return air fan
rpm	- revolutions per minute
SOW	- scope of work
sq ft	- square foot
STM	- steam
SZ	- single zone
temp.	- temperature
UH	- unit heater
UMCS	- utility monitoring and control system
VAV	- variable air volume
VSD	- variable speed drive
WAC	- window air conditioner
yr	- year(s)

EXECUTIVE SUMMARY

OBJECTIVE

The Feasibility Study for HVAC Upgrade was performed as part of the Energy Engineering Analysis Program (EEAP). The purpose of the Feasibility Study for HVAC Upgrade is to determine the economic feasibility of replacing failed or failing HVAC equipment in 70 buildings at Fort Riley, Kansas. This study is being performed in conjunction with the Feasibility Study for Installation of UMCS at Fort Riley. Two hundred sixteen buildings are evaluated in the UMCS study.

FACILITY DATA AND BUILDING SELECTION

Several types of buildings are evaluated in this study. The building types include administration buildings, barracks, chapels, clinics, dining facilities, maintenance shop buildings, recreational facilities, flight simulator buildings, and training buildings. The energy sources for these buildings include two fuel types, electricity and natural gas.

Seventy buildings were selected from a list of 216 buildings, which are also included in the UMCS feasibility study. Three data sources were used to select the buildings with failed or failing HVAC systems for the analysis. The three data sources included:

- Building lists from the Fort Riley Public Works Energy Branch of specific buildings to include in the analysis.
- List of 235 buildings from the Fort Riley Maintenance Shop listing the condition of HVAC systems and controls.
- Field survey data from 216 buildings surveyed by EMC Engineers, Inc. for the purpose of an UMCS feasibility study.

METHODOLOGY

A field survey was performed to document the HVAC system components for repair and to document information for replacement of existing HVAC systems. HVAC system components were visually inspected for damage, missing parts, and functionality. The HVAC systems were also observed for possible replacement with new, more efficient HVAC systems. Mechanical equipment rooms and building spaces were observed for space requirements and clearances for installation of proposed HVAC system replacements. Building use and building space conditions were also observed as part of the field survey for proposed HVAC system replacements.

HVAC system descriptions and conditions were tabulated from the field survey data. The HVAC system components for repair were listed and repair costs developed. Where applicable, the proposed HVAC systems for replacement were identified and evaluated for technical feasibility for those buildings. Construction costs were developed for the proposed HVAC replacement systems.

The energy savings for HVAC replacement systems were estimated through computer modeling of the existing and the proposed energy efficient HVAC systems. Representative buildings from the UMCS feasibility study were used as the baseline computer models in this analysis. Energy savings for proposed HVAC replacement systems from the representative buildings were prorated on a square foot basis to derive energy savings for similar building HVAC system replacements.

Life cycle cost analyses were performed for the proposed HVAC system replacements in accordance with ECIP guidance, using the calculated energy savings and systems replacement costs. Energy savings and costs for the proposed HVAC system replacements were summarized.

SUMMARY

HVAC system components in need of repair were found in 40 of the 70 buildings evaluated.

The proposed HVAC system replacements were analyzed for 39 of the 70 buildings evaluated. A total of 51 proposed HVAC system replacements were analyzed. The economic analysis for the proposed HVAC system replacements revealed that 32 of the 51 HVAC systems analyzed qualified for the ECIP funding program (simple paybacks below 10 years and SIRs greater than 1.25).

RECOMMENDATIONS

The HVAC system components, presented in Table ES-1 on page ES-4, are recommended for repair to restore the existing HVAC systems to their intended operating condition. Some of the HVAC systems evaluated overlapped between the analyses for HVAC repair and replacement. Those HVAC systems which qualified economically for replacement were removed from the HVAC components for repair list. The total cost for the recommended HVAC system components for repair is \$56,887.

The HVAC systems, presented in Table ES-2 on page ES-5, are recommended for replacement with more energy efficient HVAC systems. The 32 proposed HVAC system replacements which qualified for the ECIP funding program are recommended to be submitted for project funding.

The proposed HVAC systems not qualifying for the ECIP funding program were not recommended for replacement. The nonrecommended HVAC system replacements are presented in Table ES-3 on page ES-7.

**TABLE ES-1
RECOMMENDED HVAC COMPONENTS FOR REPAIR**

BLDG TYPE	BLDG NO.	BLDG NAME	DESCRIPTION OF HVAC COMPONENTS FOR REPAIR	REPAIR COST (\$)
Admin. Buildings	302	FINANCE ADMIN	FAN BEARING	91
	313	CIV PERS BLDG	CONDENSER COIL (PLUS COVER)	797
	7636	REGIMENTAL HQ BLDG	CONTROL VALVE 2-1/2"	1,050
	8056	DET DAY ROOM	PUMP, 3/4 HP	744
Admin. & Supply Buildings	7602	ADMIN & SUPPORT BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7608	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7652	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7658	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
Barracks Buildings	7612	ENL BARRACKS W/AS	PUMP SEAL	208
	7614	ENL BARRACKS W/AS	PUMP SEAL	625
	7810	ENL BARRACKS W/O DIN	PUMP SEAL	417
	7814	ENL BARRACKS W/O DIN	PUMP, 2 HP & PUMP SEAL	1,219
	8002	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8012	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8014	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8038	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8040	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8042	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8048	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8050	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
Maintenance Shops	8052	SR ENL QTRS	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	723	MNT HANGAR COMB	PUMP SEAL, CONDENSATE PUMP GASKET & CONDENSATE SHUT-OFF CONTROLS	1,439
	727	MNT HANGAR COMB	DAMPER ACTUATOR, PUMP SEAL, CONDENSATE PUMP GASKET, CONDENSATE SHUT-OFF CONTROLS & PUMP MOTOR, 1/3 HP	1,935
	741	MNT HANGAR COMB	REPLACE FOUR STEAM HEATING COILS, 980,000 BTUH CAPACITY EACH	4,975
	820	TAC EQUIP SHOP	CONTROL VALVE 1-1/2", PUMP MOTOR, 10 HP & PUMP SEAL	2,094
	8390	TAC EQUIP SHOP	DAMPER ACTUATOR, CONTROL VALVE 1" & CONTROL VALVE 3/4"	1,975
Recreation & Retail Facilities	202	PHYS FITNESS CTR	CONDENSER COIL (PLUS COVER)	979
	7485	BOWLING ALLEY	VARIABLE SPEED DRIVE W/ CONTRLER, 10HP	3,459
	6914	EXC MAIN RETL	CONTROL VALVE 1-1/2", CONTROL VALVE 2", CONTROL VALVE 1-1/4" & DAMPER ACTUATOR	2,098
	6940	INDOOR SWIM POOL	DAMPER ACTUATOR	223
Simulator Building	7739	MOVING TARGET SIMULATOR BLDG	DAMPER ACTUATOR	893
Training Building	6620	COMMUN ACT CTR	PUMP SEAL	417
TOTAL REPAIR COST				\$56,887

**TABLE ES-2
RECOMMENDED HVAC SYSTEM REPLACEMENTS**

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND KW COST SAVINGS (\$/yr)	TOTAL ENERGY SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON-RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
7485	BOWLING ALLEY	Convert DD to DD w/ VAV	(293)	488	196	(\$1,205)	\$5,907	\$850	\$5,552	\$0	\$0	\$15,055	2.71	5.61
7665	DENTAL CLINIC	Convert MZ to VAV	(107)	301	194	(\$440)	\$3,637	\$637	\$3,834	\$0	\$0	\$12,210	3.18	4.85
7670	DENTAL CLINIC	Convert DD to DD w/ VAV	(173)	889	716	(\$713)	\$10,760	\$958	\$11,006	\$0	\$0	\$40,355	3.67	4.26
602	DENTAL CLINIC	Convert DD to DD w/ VAV	(132)	681	548	(\$546)	\$8,237	\$1,242	\$8,934	\$0	\$0	\$35,342	3.96	3.94
6940	INDOOR SWIM POOL	Replace H&V with Heat Recovery Unit	7,727	706	8,434	\$31,836	\$8,545	\$0	\$40,381	\$0	\$0	\$199,226	4.93	3.61
7245	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7606	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7654	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7804	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7856	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
6620	COMMUN ACT CTR	Replace SZ AHUs with VAV AHUs	199	478	677	\$821	\$5,778	\$539	\$7,138	\$0	\$30,326	\$47,075	5.44	2.99
7404	ENL BARRACKS W/O DIN	Convert two MZs to VAVs	0	364	364	\$0	\$4,402	\$378	\$4,780	\$0	\$0	\$26,055	5.45	2.90
410	ENL BARRACKS W/AS	Replace MZs with VAV AHUs	(730)	997	267	(\$3,008)	\$12,061	\$1,309	\$10,362	\$0	\$51,813	\$77,512	5.98	2.59
402	ENL BARRACKS W/AS	Replace MZs and SZ with VAV AHUs	(730)	997	267	(\$3,008)	\$12,061	\$1,309	\$10,362	\$0	\$49,221	\$78,851	6.15	2.52
5000	FIRE STATION	Replace MZ with 3 Furnance AC Units, Replace Boiler with smaller Boiler, and Replace ACCU with 3 smaller ACCUs	196	82	278	\$808	\$991	(\$47)	\$1,752	\$652	\$72,986	\$41,284	6.82	2.48
7245	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$72,585	7.35	2.47
6620	COMMUN ACT CTR	Convert MZ to VAV	(9)	176	167	(\$35)	\$2,129	(\$122)	\$1,972	\$0	\$0	\$13,076	6.63	2.40
7804	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$78,207	7.92	2.29
7856	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$78,207	7.92	2.29
227	ENL BARRACKS W/AS	Replace MZs and SZs with VAV AHUs	(852)	1,163	311	(\$3,510)	\$14,071	\$1,527	\$12,089	\$0	\$70,248	\$111,119	7.12	2.18
7806	BN HQ BLDG	Replace SZs with VAV AHUs	(95)	263	168	(\$392)	\$3,183	\$735	\$3,526	\$0	\$23,323	\$34,973	7.45	2.13
7086	UNIT CHAPEL	Replace SZ with VAV AHU	122	92	214	\$504	\$1,108	\$183	\$1,794	\$0	\$12,554	\$19,280	7.96	2.09
222	ADMIN GEN PURP	Replace SZ with VAV AHU	(127)	260	133	(\$523)	\$3,145	\$809	\$3,431	\$0	\$14,214	\$31,811	7.68	2.03
7606	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$89,312	9.05	2.01
7654	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$89,312	9.05	2.01
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery Unit	3,223	295	3,517	\$13,277	\$3,563	\$0	\$16,840	\$0	\$35,706	\$173,802	9.33	1.90
7178	MOTOR POOL ADMIN	Replace 3 Win. ACs with small SZ w/ DX coil	0	52	52	\$0	\$628	\$826	\$1,454	(\$141)	\$4,071	\$12,511	8.25	1.89
7245	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,367	8.80	1.74

**TABLE ES-2
RECOMMENDED HVAC SYSTEM REPLACEMENTS**

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND KW COST SAVINGS (\$/yr)	TOTAL ENERGY COST SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON-RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
7606	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7654	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7804	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7856	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
TOTALS FOR ENERGY SAVINGS, COST SAVINGS, AND INVESTMENTS			32,019	9,679	41,698	\$131,911	\$117,151	\$14,698	\$263,762	(\$394)	\$1,131,307	\$1,995,765	-	-

**TABLE ES-3
NONRECOMMENDED HVAC SYSTEM REPLACEMENTS**

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND KW COST SAVINGS (\$/yr)	TOTAL ENERGY COST SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON-RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
7176	MOTOR POOL MNT SHO	Replace UHs and Steam Boiler with IR Tube Heating System	83	28	112	\$343	\$344	\$0	\$688	\$600	\$24,734	\$27,000	10.70	1.56
3	POST CHAPEL	Replace SZ, H&V, Slim Boiler and Cooling Tower with VAV AHU, HW Boiler, and Water Chiller	212	136	348	\$874	\$1,649	\$131	\$2,653	\$724	\$48,583	\$68,200	11.75	1.42
820	TAC EQUIP SHOP	Replace HW UHs with Gas-fired Infrared Radiant Tube System; Down size HW Boiler	104	11	115	\$427	\$133	\$0	\$560	\$370	\$43,700	\$37,546	12.05	1.42
7739	MOVING TARGET	Replace MZ with VAV AHU	(37)	101	65	(\$151)	\$1,227	\$283	\$1,359	\$0	\$14,830	\$27,484	13.09	1.23
741	MNT HANGAR COMB	Replace Industrial Type UHs with Gas-fired Infrared Radiant Tube System	626	213	839	\$2,578	\$2,583	\$0	\$5,161	\$600	\$63,690	\$142,228	15.90	1.07
7602	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
7608	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
7652	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
7658	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
6914	EXC MAIN RETL	Convert two MZs to VAVs	(4)	145	141	(\$18)	\$1,757	(\$18)	\$1,722	\$0	\$0	\$29,431	17.09	0.93
7612	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7614	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7616	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7810	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7814	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery, Dehumidification, and Pool Heating Unit	3,223	(559)	2,663	\$13,277	(\$6,769)	\$0	\$6,508	\$0	\$35,706	\$202,172	24.38	0.82
7243	ADMIN & SUPPLY BLDG	Replace 15 Win. ACs with 5 small SZs w/ DX coils	0	50	50	\$0	\$600	\$790	\$1,390	(\$704)	\$19,638	\$43,596	26.13	0.64
8025	BN ADMIN & CLRM	Convert MZs to VAVs	0	65	65	\$0	\$791	(\$112)	\$679	\$0	\$0	\$17,262	25.45	0.63
202	PHYS FITNESS CTR	Replace two Industrial Type Unit Heaters in Basketball Gym with four H&V Units	148	20	167	\$609	\$236	\$48	\$894	\$0	\$17,611	\$64,001	36.08	0.48

Five energy retrofit projects were identified for HVAC upgrade by the Fort Riley Public Works Energy Branch. These projects were recommended for funding under the Federal Energy Management Program (FEMP). The five projects are presented in Table ES-4.

Table ES-4. HVAC Energy Retrofit Projects Recommended for FEMP

Project No.	Project Description
Project No. 1 Upgrade HVAC Systems in Dental Clinics	
	<ul style="list-style-type: none"> • Building 602 - Convert DD AHU to DD VAV AHU
	<ul style="list-style-type: none"> • Building 7665 - Convert MZ AHU to VAV AHU
	<ul style="list-style-type: none"> • Building 7670 - Convert DD AHU to DD VAV AHU
Project No. 2 Upgrade HVAC Systems in Dining Facilities	
	<ul style="list-style-type: none"> • Building 7245 <ul style="list-style-type: none"> - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
	<ul style="list-style-type: none"> • Building 7606 <ul style="list-style-type: none"> - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
	<ul style="list-style-type: none"> • Building 7654 <ul style="list-style-type: none"> - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
Project No. 3 Upgrade HVAC Systems in Indoor Swimming Pool Buildings	
	<ul style="list-style-type: none"> • Building 6940 - Replace H&V with HRU
	<ul style="list-style-type: none"> • Building 8069 - Replace H&Vs with HRUs
Project No. 4 Upgrade HVAC Systems in Bowling Alley and Community Activities Center	
	<ul style="list-style-type: none"> • Building 7485 (Bowling Alley) - Convert DD AHU to DD VAV AHU
	<ul style="list-style-type: none"> • Building 6620 (Community Activities Center) <ul style="list-style-type: none"> - Replace SZ AHUs with VAV AHUs - Convert MZ AHU to VAV AHU

Project No.	Project Description
Project No. 5	Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin, and Battalion Headquarters
	<ul style="list-style-type: none"> • Building 5000 (Fire Station) BLR <ul style="list-style-type: none"> - Replace MZ AHU with three Furnace Air Conditioners - Replace ACCU with three Smaller ACCUs - Replace HW Boiler with Smaller Modular HW
	<ul style="list-style-type: none"> • Building 7086 (Unit Chapel) <ul style="list-style-type: none"> - Replace SZ AHU with VAV AHU
	<ul style="list-style-type: none"> • Building 7178 (Motor Pool Admin) <ul style="list-style-type: none"> - Replace three WACs with SZ AHU and ACCU
	<ul style="list-style-type: none"> • Building 7806 (Battalion Headquarters) <ul style="list-style-type: none"> - Replace SZ AHU with VAV AHUs

The energy savings and economic parameters for the projects are presented in Table ES-5 on the page ES-10.

**TABLE ES-5
ECONOMIC SUMMARY FOR ENERGY RETROFIT PROJECTS**

FEMP ENERGY RETROFIT PROJECT FOR HVAC UPGRADE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND kW COST SAVINGS (\$/yr)	TOTAL ENERGY COST SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON- RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
Project No. 1 Dental Clinics (Bldgs 602, 7665, 7670)	(412)	1,871	1,459	(\$1,697)	\$22,639	\$2,837	\$23,779	\$0	\$0	\$87,908	3.70	4.22
Project No. 2 Dining Facilities (Bldgs 7245, 7606, and 7654)	14,280	837	15,117	\$58,834	\$10,128	\$2,139	\$71,100	(\$543)	\$460,107	\$622,370	6.65	2.66
Project No. 3 Indoor Swimming Pools (Bldgs 6940 and 8069)	10,950	1,001	11,951	\$45,114	\$12,112	\$0	\$57,226	\$0	\$35,706	\$373,029	6.32	2.81
Project No. 4 Bowling Alley and Comm. Act. Center (Bldgs 7485 and 6620)	(103)	1,142	1,039	(\$424)	\$13,818	\$1,267	\$14,661	\$0	\$30,326	\$75,206	4.65	3.41
Project No. 5 Fire Station, Unit Chapel, Motor Pool Admin, and Bn HQ (Bldgs 5000, 7086, 7178, and 7806)	223	489	712	\$919	\$5,917	\$1,697	\$8,533	\$511	\$112,934	\$108,048	7.36	2.23

1. GENERAL DESCRIPTION

1.1 AUTHORITY FOR FEASIBILITY STUDY FOR HVAC UPGRADE STUDY

The Feasibility Study for HVAC Upgrade was performed as part of the Energy Engineering Analysis Program (EEAP). This feasibility study was conducted and prepared under Contract No. DACA01-94-D-0033 issued by the Kansas City District Corps of Engineers on 14 September 1994.

1.2 PURPOSE FOR FEASIBILITY STUDY FOR HVAC UPGRADE STUDY

The purpose of the Feasibility Study for HVAC Upgrade is to determine the economic feasibility of replacing failed or failing HVAC equipment in 70 buildings at Fort Riley, Kansas. This study is being performed in conjunction with the Feasibility Study for Installation of UMCS at Fort Riley. Two hundred sixteen buildings are evaluated in the UMCS study.

1.3 SCOPE OF WORK

The Scope of Work for this EEAP study is presented in Appendix A. The requirements outlined in the Scope of Work are summarized as follows:

- Review the available design, construction, and operational data for the HVAC systems.
- Conduct a field survey of selected buildings to verify construction features, electrical and mechanical equipment, occupancy, and mode of operation for energy analysis; and to evaluate the condition of existing HVAC equipment and controls. A total of 70 buildings will be evaluated for HVAC repair and replacement.
- Evaluate failed or failing HVAC systems identified during the survey to determine necessary repairs.
- Provide recommendations with potential energy savings and economic feasibility for replacing the systems in approximately 30% of the buildings with more efficient systems.
- Provide complete programming or implementation documentation for all recommended projects.
- Prepare a comprehensive report to document the work performed, the results, and the recommendations.

1.4 APPROACH

The approach taken in performing the EEAP study included the following:

- Selecting 70 buildings for evaluation. A field survey was completed on 216 buildings for the purpose of an UMCS feasibility study. The field survey data and data received from Fort Riley Public Works Energy Branch and Maintenance Shop personnel were used to select the 70 buildings for evaluation.
- Performing a field survey to document the HVAC system components for repair and to document information for replacement of existing HVAC systems.
- Interviewing maintenance personnel for HVAC system conditions, operation, and historical data.
- Reviewing existing building drawings, as available.
- Developing HVAC system descriptions and listing HVAC system conditions from the field survey data.
- Determining the HVAC system components for repair; developing repair costs.
- Determining the HVAC systems for replacement; developing systems replacement costs.
- Evaluating the energy savings available for HVAC systems replacement, using computer energy simulations for typical buildings.
- Performing LCCAs for HVAC systems replacement in accordance with ECIP guidance, using the calculated energy savings and systems replacement costs.
 - Nonrecurring savings were included for replacement of existing equipment. Most of the existing equipment for replacement is near the end of its service life. It is estimated that during the next five years the existing equipment will need to be replaced, therefore the non-recurring savings were calculated using the fifth year discount factor.
- Summarizing energy savings and costs for HVAC systems replacement.

The results of the feasibility study analysis are presented in two volumes: Volume I presents the study information, conclusions and recommendations, Volume II contains the appendices and the backup data.

1.5 WORK REMAINING TO COMPLETE PROJECT

There are no tasks remaining to complete this project

2. FACILITY DATA

2.1 GENERAL

Several types of buildings are evaluated in this study. The building types include administration buildings, barracks, chapels, clinics, dining facilities, maintenance shop buildings, recreational facilities, flight simulator buildings, and training buildings. The energy sources for these buildings include two fuel types, electricity and natural gas.

2.2 BUILDINGS INCLUDED IN ANALYSIS

Seventy buildings were selected from a list of 216 buildings, which are also included in the UMCS feasibility study. Three data sources were used to select the buildings with failed or failing HVAC systems for the analysis. The three data sources included:

- Building lists from the Fort Riley Public Works Energy Branch of specific buildings to include in the analysis (see Appendix B).
- List of 235 buildings from the Fort Riley Maintenance Shop listing the condition of HVAC systems and controls (see Appendix B).
- Field survey data from 216 buildings surveyed by EMC Engineers, Inc. for the purpose of an UMCS feasibility study.

The 70 buildings selected for the analysis are presented in Table 2-1 on the following page. The buildings are grouped by use and arranged in tabular format to correspond to the building discussions presented in Section 4.

Table 2-1. Buildings Selected for HVAC Upgrade Analysis

TAB	BLDG NO.	BLDG NAME	SQ FT	USE	EXISTING HVAC SYSTEM TYPE
Admin. Buildings 1	200	ADMIN GENERAL PURPOSE	60,690	Admin - block	Water Source Heat Pumps
	222	ADMIN GEN PURP	18,854	Admin - block	Win. ACs / P. Rad. / SZ
	302	FINANCE ADMIN	16,138	Admin - block	VAV w/ Reheat
	313	CIV PERS BLDG	6,222	Admin - block	SZ w/ Duct Furnance
	500	POST HQ BLDG	65,453	Admin - block	Water Source Heat Pumps
	509	ADM GEN PURPOSE	10,108	Admin - block	Water Source Heat Pumps
	5000	FIRE STATION	8,400	24 hours	MZ / H&V / Gas IRs
	7178	MOTOR POOL ADMIN	2,480	Admin	Gas-Fired UHs / Win. ACs
	7636	REGIMENTAL HQ BLDG	9,850	Admin	Dual Temp. FCs / SZ
	8056	DET DAY ROOM	2,100	Admin	SZ
Admin. & Supply Buildings 2	7243	ADMIN & SUPPLY BLDG	17,829	Admin & Supply	Win. AC / P. Rad. / FCs in building addition
	7432	ADMIN & SUPPLY BLDG	13,500	Admin & Supply	Dual Temp. FCs / H&Vs
	7602	ADMIN & SUPPLY BLDG	13,520	Admin & Supply	SZs (Clg Only) / P. Rad. (All)
	7608	ADMIN & SUPPLY BLDG	13,520	Admin & Supply	SZs (Clg Only) / P. Rad. (All)
	7652	ADMIN & SUPPLY BLDG	13,520	Admin & Supply	SZs (Clg Only) / P. Rad. (All)
	7658	ADMIN & SUPPLY BLDG	13,520	Admin & Supply	SZs (Clg Only) / P. Rad. (All)
	8021	ADMIN & SUPPLY BLDG	23,676	Admin & Supply	Dual Temp. FCs / H&Vs
	8057	ADMIN & SUPPLY BLDG	23,676	Admin & Supply	Dual Temp. FCs / H&Vs
Barracks Buildings 3	227	ENL BARRACKS W/AS	32,303	Barracks - block	MZs
	402	ENL BARRACKS W/AS	35,718	Barracks - block	MZs
	410	ENL BARRACKS W/AS	32,883	Barracks - block	MZs
	540	OFF QTRS MILIT	14,528	Barracks - block	Dual Temp. FCs
	7404	ENL BARRACKS W/O DIN	50,967	Barracks	MZ / P. Rad.
	7612	ENL BARRACKS W/AS	41,892	Barracks	Dual Temp. FCs / SZs
	7614	ENL BARRACKS W/AS	41,892	Barracks	Dual Temp. FCs / SZs
	7616	ENL BARRACKS W/AS	41,892	Barracks	Dual Temp. FCs / SZs
	7810	ENL BARRACKS W/O DIN	41,843	Barracks	Dual Temp. FCs / SZs
	7814	ENL BARRACKS W/O DIN	41,843	Barracks	Dual Temp. FCs / SZs
	7050	ENL BARRACKS W/DIN	39,675	Barracks & Dining	Dual Temp. FCs / H&V / SZ
	7053	ENL BARRACKS W/AS	39,675	Barracks & Dining	Dual Temp. FCs
	8002	ENL BARRACKS W/O DIN	22,700	Barracks	Dual Temp. FCs
	8012	ENL BARRACKS W/O DIN	22,700	Barracks	Dual Temp. FCs
	8014	ENL BARRACKS W/O DIN	11,549	Barracks	Dual Temp. FCs
	8038	ENL BARRACKS W/O DIN	22,700	Barracks	Dual Temp. FCs
	8040	ENL BARRACKS W/O DIN	11,549	Barracks	Dual Temp. FCs
	8042	ENL BARRACKS W/O DIN	22,700	Barracks	Dual Temp. FCs
	8048	ENL BARRACKS W/O DIN	11,549	Barracks	Dual Temp. FCs
	8050	ENL BARRACKS W/O DIN	11,549	Barracks	Dual Temp. FCs
	8052	SR ENL QTRS	22,700	Barracks	Dual Temp. FCs
Battalion Buildings 4	7806	BN HQ BLDG	13,493	Battalian	SZs / P. Rad.
	8025	BN ADMIN & CLRM	12,000	Battalian	MZs / P. Rad.
Chapel Buildings 5	3	POST CHAPEL	8,828	Church - block	SZ / H&V
	7086	UNIT CHAPEL	8,696	Church	SZ / FCs
Dental Clinic Buildings 6	602	DENTAL CLINIC	11,557	Clinic	DD
	7665	DENTAL CLINIC	11,076	Clinic	MZ
	7670	DENTAL CLINIC	14,960	Clinic	DD
Dining Facilities 7	7245	ENL PERS DIN	13,998	Dining	SZs / H&Vs
	7606	ENL PERS DIN	13,493	Dining	SZs / H&Vs
	7654	ENL PERS DIN	13,493	Dining	SZs / H&Vs
	7804	ENL PERS DIN	13,493	Dining	SZs / H&Vs
	7856	ENL PERS DIN	13,493	Dining	SZs / H&Vs

Table 2-1. Buildings Selected for HVAC Upgrade Analysis

TAB	BLDG NO.	BLDG NAME	SQ FT	USE	EXISTING HVAC SYSTEM TYPE
Maintenance Shops 8	723	MNT HANGAR COMB	21,640	Hangar	Flr. Slab Rad. / UHs / P. Rad.
	727	MNT HANGAR COMB	36,152	Hangar	Flr. Slab Rad. / SZ / MZ / UHs
	741	MNT HANGAR COMB	38,898	Hangar	UHs / P. Rad.
	820	TAC EQUIP SHOP	20,564	Maintenance	SZ / UHs / P. Rad.
	1470	AR VEH MNT SHOP	21,667	Maintenance	UHs / SZ / MAU / P. Rad.
	7176	MOTOR POOL MNT SHOP	4,880	Maintenance	UHs
	7920	VEH MNT SHOP DS	124,553	Maintenance	Res. Furn. w/ HC / UHs / SZs / MAUs
	8390	TAC EQUIP SHOP	24,755	Maintenance	H&V / MAU / UHs
Recreation & Retail Facilities 9	202	PHYS FITNESS CTR	51,307	Gymnasium - block	SZ / UHs
	7485	BOWLING ALLEY	36,966	Recreation	DD / VAV
	6914	EXC MAIN RETL	63,930	Retail	SZs / MZs
	6940	INDOOR SWIM POOL	23,347	Swimming Pool	H&V / SZ
	8069	IN SW POOL/GYM	25,620	Swimming Pool	H&Vs / SZ
Simulator Buildings 10	722	FLIGHT SIMULATOR	7,000	Simulator	SZs / VAV
	724	FLIGHT SIMULATOR	13,188	Simulator	MZ / SZ / CRU / P. Rad.
	7739	MOVING TARGET SIM BLDG	4,074	Simulator	MZ / FCs
Training Buildings 11	6620	COMMUN ACT CTR	31,740	Training	SZs / MZ / H&V
	7604	GEN INST BLDG	1,346	Training	MZs
	7656	GEN INST BLDG	13,493	Training	MZs

The analysis includes evaluation of the replacement of existing HVAC systems with more efficient HVAC systems. The energy savings resulting from the replacement of HVAC systems were estimated through computer modeling of the existing and the proposed efficient HVAC systems.

Representative buildings from the UMCS feasibility study were used as the baseline computer models in this analysis. Table 2-2 below presents all 216 buildings from the feasibility study and shows the representative buildings (Comp Model) selected for use in the baseline models.

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
5000	FIRE STATION	8,400	24 hours	X	MZ / H&V / Gas IRs
313	CIV PERS BLDG	6,222	Admin		SZ w/ Duct Furnace
804	RGT HQ BLDG	10,241	Admin		MZ
7036	REGIMENTAL HQ BLDG	10,010	Admin		FCs / SZ
7178	MOTOR POOL ADMIN	2,480	Admin		Gas-Fired UHs / Win. ACs
7450	REGIMENTAL HQ BLDG	9,850	Admin	X	Dual Temp. FCs / SZ
7636	REGIMENTAL HQ BLDG	9,850	Admin		Dual Temp. FCs / SZ
7834	REGIMENTAL HQ BLDG	9,904	Admin		Dual Temp. FCs / SZ
8010	DET DAY ROOM	2,100	Admin		SZ
8020	DET DAY ROOM	2,100	Admin		SZ
8046	DET DAY ROOM	2,100	Admin		SZ
8056	DET DAY ROOM	2,100	Admin		SZ
8071	RGT HQ BLDG	9,963	Admin		MZ
751	AC PTS & TOE ST	9,834	Admin & Supply		Res. Furn (Htg & Clg) / UHs
810	ADMIN & SUPPLY BLDG	15,152	Admin & Supply		Dual Temp. FCs / H&V
812	ADMIN & SUPPLY BLDG	23,559	Admin & Supply		Dual Temp. FCs / H&V
835	MAF OPS BLDG	19,470	Admin & Supply		VAV / UHs / Flr. Slab Rad.
7212	CO HQ BLDG	19,320	Admin & Supply		Dual Temp. FCs / H&V
7220	CO HQ BLDG	18,870	Admin & Supply		Dual Temp. FCs / H&V
7243	ADMIN & SUPPLY BLDG	17,829	Admin & Supply		Win. AC / P. Rad. / FCs in building addition
7432	ADMIN & SUPPLY BLDG	13,500	Admin & Supply		Dual Temp. FCs / H&Vs
7602	ADMIN & SUPPLY BLDG	13,520	Admin & Supply		SZs (Clg Only) / P. Rad. (All)
7608	ADMIN & SUPPLY BLDG	13,520	Admin & Supply		SZs (Clg Only) / P. Rad. (All)
7652	ADMIN & SUPPLY BLDG	13,520	Admin & Supply		SZs (Clg Only) / P. Rad. (All)
7658	ADMIN & SUPPLY BLDG	13,520	Admin & Supply		SZs (Clg Only) / P. Rad. (All)
7802	ADMIN & SUPPLY BLDG	13,280	Admin & Supply		Dual Temp. FCs / H&Vs
7808	ADMIN & SUPPLY BLDG	13,280	Admin & Supply		Dual Temp. FCs / H&Vs
7852	ADMIN & SUPPLY BLDG	13,280	Admin & Supply		Dual Temp. FCs / H&Vs
7858	ADMIN & SUPPLY BLDG	13,280	Admin & Supply		Dual Temp. FCs / H&Vs
8021	ADMIN & SUPPLY BLDG	23,676	Admin & Supply	X	Dual Temp. FCs / H&Vs
8023	ADMIN & SUPPLY BLDG	23,676	Admin & Supply		Dual Temp. FCs / H&Vs
8057	ADMIN & SUPPLY BLDG	23,676	Admin & Supply		Dual Temp. FCs / H&Vs
8059	ADMIN & SUPPLY BLDG	23,676	Admin & Supply		Dual Temp. FCs / H&Vs
29	RED CROSS BLDG	3,000	Admin - block		Res. Furn.
200	ADMIN GENERAL PURP	60,690	Admin - block		Water Source Heat Pumps
203	CAVALRY MUSEUM	5,800	Admin - block		SZs
205	CAVALRY MUSEUM	16,496	Admin - block		SZs / FCs
207	CAVALRY MUSEUM	8,278	Admin - block		SZs

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
210	MILIT PERS BLDG	58,448	Admin - block		MZ / VAV / SZ
211	ADMIN	41,062	Admin - block		SZ / CRU / P. RAD.
222	ADMIN GEN PURP	18,854	Admin - block		Win. ACs / P. Rad. / SZ
301	FINANCE ADMIN	32,947	Admin - block		VAV w/ Reheat
302	FINANCE ADMIN	16,138	Admin - block		VAV w/ Reheat
330	DEH ADMIN	14,913	Admin - block		Res. Furn.
364	UEMCS HQ	744	Admin - block		Win. AC / Res. Furn.
403	ADM GENERAL	18,151	Admin - block		Water Source Heat Pumps
405	ADMIN GEN PURP	10,778	Admin - block		Dual Temp. FCs
406	CID BLDG	10,390	Admin - block	X	MZ
500	POST HQ BLDG	65,453	Admin - block		Water Source Heat Pumps
509	ADM GEN PURPOSE	10,108	Admin - block		Water Source Heat Pumps
610	ENL BARRACKS W/AS	29,004	Barracks		MZ / P. Rad.
620	OFF QTRS MILIT	12,640	Barracks		FCs (Htg) / Win. AC Units
621	OFF QTRS TRANS	10,723	Barracks		FCs (Htg) / Win. AC Units
5309	GUEST HOUSE	23,784	Barracks		Dual Temp. FCs
7050	ENL BARRACKS W/AS	39,675	Barracks & Dining		Dual Temp. FCs / H&V / SZ
7053	ENL BARRACKS W/AS	39,675	Barracks & Dining		Dual Temp. FCs
7404	ENL BARRACKS W/O DIN	50,967	Barracks		MZs / P. Rad.
7424	ENL BARRACKS W/O DIN	50,967	Barracks		MZs / P. Rad.
7610	ENL BARRACKS W/AS	41,892	Barracks		Dual Temp. FCs / SZs
7612	ENL BARRACKS W/AS	41,892	Barracks		Dual Temp. FCs / SZs
7614	ENL BARRACKS W/AS	41,892	Barracks		Dual Temp. FCs / SZs
7616	ENL BARRACKS W/AS	41,892	Barracks		Dual Temp. FCs / SZs
7618	ENL BARRACKS W/O DIN	41,892	Barracks	X	MZs
7642	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7644	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7646	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7648	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7650	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7810	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7812	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7814	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7816	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7818	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7842	ENL BARRACKS W/AS	41,843	Barracks		Dual Temp. FCs / SZs
7844	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7846	ENL BARRACKS W/AS	41,843	Barracks		Dual Temp. FCs / SZs
7848	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7850	ENL BARRACKS W/AS	41,843	Barracks		Dual Temp. FCs / SZs

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
8002	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8006	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8008	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8012	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8014	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8038	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8040	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8042	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8048	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8050	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8052	SR ENL QTRS	22,700	Barracks		Dual Temp. FCs
8054	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
27	OFF QTRS MILIT	38,146	Barracks - block		Heat Pumps
214	ENL BARRACKS W/AS	35,821	Barracks - block		MZs
223	ENL BARRACKS W/DAS	47,794	Barracks - block		MZs
227	ENL BARRACKS W/AS	32,303	Barracks - block		MZs
402	ENL BARRACKS W/AS	35,718	Barracks - block		MZs
404	ENL BARRACKS W/DAS	35,718	Barracks - block		VAVs
409	ENL BARRACKS W/AS	32,883	Barracks - block	X	MZs
410	ENL BARRACKS W/AS	32,883	Barracks - block		MZs
411	ENL BARRACKS W/AS	32,883	Barracks - block		MZs
512	SR ENL QTRS	13,619	Barracks - block		Dual Temp. FCs
540	OFF QTRS MILIT	14,528	Barracks - block		Dual Temp. FCs
541	OFF QTRS MILIT	18,083	Barracks - block		Dual Temp. FCs
542	OFF QTRS MILIT	14,528	Barracks - block		Dual Temp. FCs
760	BN HQ BLDG	7,364	Battalion		Strn. P. Rad.
802	BN ADMIN & CLRM	12,526	Battalion		MZs
808	BN ADMIN & CLRM	12,526	Battalion		MZs
7017	BN HQ BLDG	2,604	Battalion		Res. Furn.
7028	BN CLASSROOMS	3,733	Battalion		Dual Temp. FCs
7046	BN CLASSROOMS	3,733	Battalion		Dual Temp. FCs
7031	BN HQ BLDG	3,733	Battalion		Dual Temp. FCs
7033	BN HQ BLDG	4,083	Battalion		SZ
7047	BN HQ BLDG	3,733	Battalion		Dual Temp. FCs
7048	BN HQ BLDG	2,604	Battalion		Dual Temp. FCs
7108	BN ADMIN & CLRM	12,527	Battalion	X	MZ
7109	BN ADMIN & CLRM	13,535	Battalion		VAV w/ Reheat
7215	BN HQ BLDG	2,604	Battalion		SZ / P. Rad.
7218	BN HQ BLDG	12,625	Battalion		MZ
7270	BN HQ BLDG	6,130	Battalion		MZ

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
7410	BN ADMIN & CLRM	12,599	Battalian		VAV w/ Reheat
7620	BN ADMIN & CLRM	6,340	Battalian		MZ / P. Rad.
7622	BN ADMIN & CLRM	12,380	Battalian		MZ / P. Rad.
7624	BN ADMIN & CLRM	6,158	Battalian		MZ / P. Rad.
7630	BN ADMIN & CLRM	6,158	Battalian		MZ / P. Rad.
7638	BN ADMIN & CLRM	6,158	Battalian		MZ / P. Rad.
7806	BN HQ BLDG	13,493	Battalian		SZs
7820	BN ADMIN & CLRM	6,673	Battalian		SZ
7824	BN ADMIN & CLRM	12,246	Battalian		MZs
7836	BN ADMIN & CLRM	12,246	Battalian		MZs
7854	BN HQ BLDG	13,493	Battalian		SZs
8025	BN ADMIN & CLRM	12,000	Battalian		MZs / P. Rad.
8037	BN ADMIN & CLRM	12,000	Battalian		MZs
5302	POST OFFICE	12,240	Post Office		MZ / P. Rad.
5315	MORRIS HILL CHAPEL	19,748	Church		SZ / FCs
7086	UNIT CHAPEL	8,696	Church	X	SZ / FCs
7865	UNIT CHAPEL	8,718	Church		SZ / Win. AC Units
3	POST CHAPEL	8,828	Church - block		SZ / H&V
6	POST CHAPEL	6,230	Church - block	X	SZs / P. Rad.
253	DRUG ABUSE CTR	11,122	Clinic		SZs
602	DENTAL CLINIC	11,557	Clinic		DD
814	MEDICAL FAC - NEW	9,220	Clinic		MZ
4010	DENTAL CLINIC	15,587	Clinic		DD
7034	CLINIC W/O BEDS	3,842	Clinic		MZ
7626	CLINIC W/O BEDS	3,604	Clinic		MZ
7665	DENTAL CLINIC	11,076	Clinic	X	MZ
7670	DENTAL CLINIC	14,960	Clinic		DD
7826	CLINIC W/O BEDS	3,841	Clinic		MZ
8065	CLINIC W/O BEDS	3,848	Clinic		MZ
650	COLD STOR FAC	22,331	Cold Storage		
652	COLD STOR FAC	8,167	Cold Storage		
7245	ENL PERS DIN	13,998	Dining		SZs / H&Vs
7606A	ENL PERS DIN (Dining Area)	8,995	Dining	X	SZs
7606B	ENL PERS DIN (Kitchen Area)	4,498	Dining	X	H&Vs
7654	ENL PERS DIN	13,493	Dining		SZs / H&Vs
7804	ENL PERS DIN	13,493	Dining		SZs / H&Vs
7856	ENL PERS DIN	13,493	Dining		SZs / H&Vs
8063	ENL PERS DIN	18,313	Dining		MZ
723	MNT HANGAR COMB	21,640	Hangar		Fir. Slab Rad. / UHs / P. Rad.

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
727	MNT HANGAR COMB	36,152	Hangar		SZ / MZ / UHs
741	MNT HANGAR COMB	38,898	Hangar		UHs
817	MNT HANGAR AVUM	40,061	Hangar		Flr Slab Rad. / H&V / HCU
833	AIRCRAFT HANGAR	52,080	Hangar		Flr Slab Rad. / H&V / VAV / HCU
853	MNT HANGAR AVUM	48,112	Hangar		Flr Slab Rad. / Gas-Fired H&V / UHs
710	TAC EQUIP SHOP	2,173	Maintenance		SZ / UHs
820	TAC EQUIP SHOP	20,564	Maintenance		SZ / UHs / P. Rad.
840	VEHICLE MNT SHOP ORG	9,152	Maintenance		H&V / SZ / MAU / Win. AC Units / P. Rad. / IR Heaters
1470	AR VEH MNT SHOP	21,667	Maintenance		UHs / SZ / MAU / P. Rad.
7176	MOTOR POOL MNT SHOP	4,880	Maintenance		UHs
7350	VEH MNT SHOP ORG	21,345	Maintenance		Res. Furn. / MAU / Gas Fired IRs
7500	VEH MNT SHOP ORG	22,325	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7520	VEH MNT SHOP ORG	27,112	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7760	VEH MNT SHOP ORG	17,163	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7720	VEH MNT SHOP ORG	22,325	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7780	VEH MNT SHOP ORG	17,163	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7900	VEH MNT SHOP ORG	20,943	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7920	VEH MNT SHOP DS	124,553	Maintenance		Res. Furn. w/ HC / UHs / SZ / MAU
7940	VEH MNT SHOP ORG	22,405	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7960	VEH MNT SHOP ORG	20,245	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
8100	CONSOLIDATED MNT	224,927	Maintenance		Roof SZs / HRUs
8300	VEH MNT SHOP ORG	20,240	Maintenance	X	MAUs / Res. Furn. / Gas Fired IRs
8320	VEH MNT SHOP ORG	20,240	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
8330	VEH MNT SHOP ORG	39,256	Maintenance		UHs / H&Vs / MAU
8340	VEH MNT SHOP ORG	20,240	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
8360	VEH MNT SHOP ORG	39,428	Maintenance		H&V / UHs / MAU / Win. AC Units / Gas IR Heaters
8370	VEH MNT SHOP ORG	26,876	Maintenance		SZ / H&V / MAU
8380	VEH MNT SHOP ORG	73,400	Maintenance		Gas Fired SZ / H&V / MAU / Gas IR Heaters
8390	TAC EQUIP SHOP	24,755	Maintenance		H&V / MAU / UHs
8410	VEH MNT SHOP ORG	73,233	Maintenance		Gas Fired SZ / H&V / MAU / Gas IR Heaters
1980	RECYCLE CENTER	24,968	Maintenance		Res. Furn. / H&V
615	IACH ENERGY PLANT	10,658	Mechanical		
806	COMB AC-HTG PLANT	1,000	Mechanical		
7210	CH CHILLER PLANT	4,320	Mechanical		
8073	CH ENERGY PLANT	4,070	Mechanical		
202	PHYS FITNESS CTR	51,307	Gym - block		SZ / UHs
5800	YOUTH CTR	21,560	Youth Center		SZ / MZ

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
6940	INDOOR SWIM POOL	23,347	Swimming Pool		H&V / SZ
7024	GYMNASIUM	20,619	Recreation		H&V / FCs
7632	GYMNASIUM	20,694	Recreation		H&V / FCs
7832	GYMNASIUM	20,694	Recreation		H&V / UHs
8069A	IN SW POOL/GYM	25,620	Swimming Pool	X	H&Vs
8069B	IN SW POOL/GYM	25,620	Swimming Pool	X	H&V / SZ
6910	EXC SP ST FAC	2,525	Retail		Res Furn.
6914	EXC MAIN RETL	63,930	Retail	X	SZ / MZ
7285	CLOTHING SALES	17,042	Retail		SZ w/ Booster Coils
720	AF OPS BLDG	3,705	Simulator		Res. Furns.
722	FLIGHT SIMULATOR	7,000	Simulator		SZs / VAV
724	FLIGHT SIMULATOR	13,188	Simulator	X	MZ / SZ / CRU / P. Rad.
7739	MOVING TARGET SIM BLDG	4,074	Simulator		MZ / FCs
7485	BOWLING ALLEY	36,966	Recreation	X	DD / VAV
7866	THEATER W/DRESS RM	11,098	Theater	X	SZ
206	THEATER W/O DRESS RM	10,754	Theater		SZ
319	GEN INSTRUCTION BLDG	9,690	Training		SZ / P. Rad.
6620	COMMUN ACT CTR	31,740	Training		SZ / H&V
6918	SKILL DEV CTR	11,507	Training		Roof Top SZs / Res. Furn
7264	LIBRARY MAIN	31,240	Training		SZ / P. Rad
7305	APP INSTR BLDG	9,872	Training		Res. Furn. w/ AC
7604	GEN INST BLDG	1,346	Training		MZs
7656	GEN INST BLDG	13,493	Training	X	MZs
8044	APP INSTR BLDG	2,470	Training		Res. Furn.
TOTAL NUMBER OF COMPUTER MODEL BUILDINGS				20	

2.3 ENERGY SOURCES AND CONSUMPTION

2.3.1 Electricity

Fort Riley is served by two electrical substations. The substations are named ANZIO and IRWIN. The electrical energy consumption and electrical demand are metered at these substations. Historical electrical energy and demand use and cost data for fiscal year (FY) 1994 was obtained from billing records at Fort Riley. The electrical power is provided by the Western Resources, Inc. utility company.

Table 2-3 below presents the historical data for FY94 electrical energy consumption and electrical demand metered at the substations ANZIO and IRWIN.

Table 2-3. Historical Data for Electrical Consumption

FY 94	Electrical Demand (kW)	Electrical Demand Cost (\$)	Electrical Consumption (kWh)	Electrical Cost (\$) ¹
Oct-93	23,799	119,643	11,661,143	502,124
Nov-93	29,089	119,396	12,536,771	528,972
Dec-93	25,479	119,396	14,417,197	582,900
Jan-94	28,540	119,396	14,355,290	581,164
Feb-94	31,095	121,548	13,342,753	555,176
Mar-94	23,364	119,396	12,487,960	527,369
Apr-94	24,630	119,396	11,933,772	510,330
May-94	32,014	124,219	12,540,938	534,752
Jun-94	35,469	137,619	16,953,600	681,157
Jul-94	35,750	138,670	16,754,188	676,880
Aug-94	35,489	134,668	17,613,148	700,116
Sept-94	33,945	131,703	14,756,495	609,992
Totals	358,663	1,505,050	169,353,256	6,990,930
Electrical Demand Unit Cost is calculated using a demand limiting computer spreadsheet provided by the Fort Riley Public Works Energy Branch.			Electrical Energy Unit Cost w/ Demand \$0.0413 / kWh \$12.10 / MBtu	
			Electrical Energy Unit Cost w/o Demand \$0.0322 / kWh \$9.44 / MBtu	

1. Cost for kWh includes kW cost.

2.3.2 Natural Gas

Historical data for natural gas consumption was obtained from billing records at Fort Riley. Table 2-4 presents the natural gas consumption and cost data for FY94.

Table 2-4. Historical Data for Natural Gas Consumption

FY 94	Natural Gas Consumption (MBtu)	Natural Gas Unit Price	Total Natural Gas Cost
Oct 93	70,695	\$3.88	\$274,297
Nov 93	150,142	\$4.08	\$612,579
Dec 93	186,439	\$4.54	\$846,433
Jan 94	233,073	\$4.19	\$976,576
Feb 94	199,962	\$4.37	\$873,834
Mar 94	130,497	\$4.38	\$571,577
Apr 94	85,400	\$3.96	\$338,184
May 94	36,474	\$3.98	\$145,167
Jun 94	39,047	\$3.18	\$124,170
Jul 94	39,483	\$3.32	\$131,084
Aug 94	37,667	\$3.24	\$122,041
Sep 94	35,304	\$3.06	\$108,030
Totals	1,244,183		\$5,123,971
Unit Cost of NG			\$4.12 / MBtu

3. FIELD SURVEY OF HVAC SYSTEMS

3.1 GENERAL

A field survey was conducted on 70 buildings for the purpose of upgrading the existing HVAC systems. The typical HVAC systems included in the field survey are listed below:

- Air Handling Units
- Fan Coil Units
- Unit Heaters
- Heat Pumps
- Window Air Conditioners
- Water Chillers
- Cooling Towers
- Air Cooled Condensing Units
- Steam Boilers
- HW Boilers
- Steam-to-HW Converters
- HW and CW Pumps

Field survey forms were used to record the existing conditions of the HVAC systems. The field survey forms are presented in Volume II of this report.

3.2 OVERVIEW OF FIELD SURVEY OBSERVATIONS

3.2.1 Typical HVAC System Components for Repair

A vital part of the field survey included the HVAC system components for repair. HVAC system components were visually inspected for damage, missing parts, and functionality. HVAC system components for repair were recorded on the field survey forms. Some of the typical HVAC system components for repair are described below.

Some air handling units were observed to have the following components in need of repair:

- Damper actuators - missing or linkages disconnected.
- Fan Motors - noisy bearings.
- Fans - noisy bearings.
- Control valves - actuators dismantled or leak; valve bodies extremely rusted.

The HVAC system components on chillers, air cooled condensing units, cooling towers, boilers, and converters were observed to be generally in fair condition.

Some pumps were observed to have the following components in need of repair:

- Motors - noisy bearings.
- Pump seals - leaky.

3.2.2 Typical HVAC Systems for Replacement

The HVAC systems were also observed for possible replacement with new, more efficient HVAC systems. Mechanical equipment rooms and building spaces were observed for space requirements and clearances for installation of proposed HVAC system replacements. Building use and building space conditions were also observed as part of the field survey for proposed HVAC system replacements.

In selecting replacement systems, the design philosophy was to identify replacement HVAC systems which would result in reduced maintenance costs and increased reliability, as well as conserve energy. The proposed HVAC systems considered for replacement included:

- Replacement of dual temperature fan coil systems with VAV systems. The VAV system would have the heating and cooling coil at the AHU. Air distribution ductwork would be installed with VAV terminal units to vary air to each room. This system would result in significant maintenance savings as well as significant energy savings.
- Replacement of single zone and multizone systems with VAV systems is an effective way to save energy. With the exception of controls, VAV is the only HVAC replacement option available for these systems capable of saving significant energy. In most buildings, fan energy consumption exceeds cooling energy.
- Conversion of multizone systems to VAV systems. VAV terminal units would be installed on each of the zones ductwork in the MER near the AHU where they are easy to maintain. The existing air distribution ductwork is retained. A VSD on the supply fan would provide significant energy savings.
- Conversion of dual duct systems to VAV systems. Dual duct mixing boxes would be removed, and dual duct VAV mixing boxes would be installed. The existing air distribution ductwork is retained. A VSD on the supply fan would provide significant energy savings.
- Replacement of HVAC systems requiring 100% outside air with heat recovery units. Heat recovery units are very cost effective for replacement of these type of HVAC systems. Typical applications include makeup air units for kitchen hoods in dining facilities and HVAC systems in indoor swimming pools.

- Replacement of single zone and multizone systems with high efficiency residential style furnaces. The high efficiency residential style furnaces are often superior to single zone and multizone systems in terms of low first costs, energy efficiency, and size.
- Replacement of unit heaters in maintenance shops with infrared heating systems. The infrared heating systems are superior to unit heaters in terms of both energy efficiency and thermal comfort.

4. DESCRIPTION AND ASSESSMENT OF HVAC SYSTEMS

4.1 BUILDING 200 (ADMINISTRATION GENERAL PURPOSE)

4.1.1 HVAC System Existing Conditions

Building 200 is a 60,690 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900s and has sandstone block foundations and walls. This building has a variety of administrative offices, an auditorium, and a computer operations center. The building is served by water source heat pumps that provide heating and cooling throughout (except the computer operations center which has a separate HVAC system).

The water source heat pump system was installed in 1986. The main components in this system are heat pumps (console type heat pumps located along walls and below windows or horizontal type heat pumps located above ceilings), condenser water circulating pumps, a cooling tower, 10 thermal energy storage tanks, a flat plate heat exchanger, and two steam boilers. The condenser water is a mixture of 15% propylene glycol and 85% water. The cooling tower is a closed circuit cooling tower.

The water source heat pump system components are in good condition, although the heat pumps have had a tendency to burn out compressors. A number of problems have plagued the system operation from the time it was installed. The problems encountered with the water source heat pump system include the following:

- The heat pumps have leakage problems.
- The heat pumps have compressor burn out problems. This is due to continuous operation and system control, as people have the thermostat controls set on full cool or full heat. Ft. Riley maintenance personnel have observed open windows near heat pumps operating in the full heating or full cooling mode.
- The console type heat pumps have been used for shelves to store books and papers, or have desks or cabinets in front of them blocking access. This misuse of the heat pumps has caused air flow blockage resulting in icing of coils and inefficient operation.
- The horizontal type heat pumps above ceilings are difficult to maintain. On these type of heat pumps, access to the unit is gained by sliding the cover off vertically. The heat pump must therefore be removed from the ceiling space to perform routine maintenance.
- The heat pumps shutdown when the condenser water temperature rises above 85°F or drops below 65°F. The condenser water must be stabilized between these temperatures before the heat pumps can be reset. This building has approximately

133 heat pumps which would need to be reset if the condenser water temperature rises above or drops below the system temperature setpoints.

- The condenser water system piping has developed many leaks. Part of the problem is that the copper pipe fittings were joined together with soft solder. Over time the fittings have begun to leak, and some have completely blown apart causing a tremendous repair effort. Large amounts of the propylene-water mixture have been lost, requiring the system to be refilled. Replacement cost of the propylene-water mixture is very expensive.
- The cooling towers did not receive proper chemical treatment during the first year in service. The chemical treatment was provided under warranty by the installation contractor. A build up of scale occurred inside the cooling towers. As a result, the piping, valves, and spray nozzles were plugged with scale. Maintenance has been done since then to clean out some of the built-up scale.

4.1.2 HVAC System Components for Repair

The HVAC system components were observed to be in good condition and operating at the time of the field survey.

4.1.3 Proposed HVAC System Replacement

The existing heat pump system was installed 9 years ago, and was not considered for a replacement HVAC system.

4.1.4 Recommendations

The problems associated with the water source heat pump system can be grouped into three categories:

- Misuse of the water source heat pumps by building users.
- Intensive maintenance required for water source heat pump system operation.
- Lack of system controls to maintain proper water source heat pump system operation.

The water source heat pump system problems could be alleviated by implementing the following:

- Provide building user training for heat pump operation.

- Continue regular maintenance and replace failed heat pumps with quality heat pumps.
- Install DDC system controls to monitor water source heat pump system operation and water source temperature, and provide alarms to indicate when the system shuts down or when the water source temperature is out of proper range. Additionally, automatic control valves could be installed at strategic locations on the condenser water piping. If a break occurs in the condenser water piping system, the control valves would close automatically and retain most of the propylene-water mixture.

The water source heat pump system is being evaluated to be upgraded with DDC controls as part of the installation of a UMCS.

4.2 BUILDING 222 (ADMINISTRATION GENERAL PURPOSE)

4.2.1 HVAC System Existing Conditions

Building 222 is a 18,854 sq ft, building. The majority of the building is a single story. The north end of the building has two stories which contain first and second floor administration offices. It was constructed during the early 1900s and has sandstone block foundations and walls. This building has administrative offices, a Class Six liquor store, a training center (currently vacant), a cold storage, and a dry storage.

The following table describes the HVAC equipment serving Building 222.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU serves Class Six liquor store and training center	Poor condition - inoperable OA/RA damper actuator
CH-1	Reciprocating w/ Air Cooled Cond.	30 Ton packaged air-cooled water chiller serves AHU-1	Good condition
WAC-1 Thru WAC-9	Window Air-Conditioners	9 WACs provide cooling for the administrative offices (1st & 2nd floors, north end)	Fair condition
RAD-1	Finned Tube Baseboard Radiation	Perimeter radiation provides heating for the administrative offices (1st & 2nd floors, north end)	Fair condition
BLR-1	HW Boiler	350,000 BTUH (output) Boiler serves AHU-1 and RAD-1 perimeter radiation	Fair condition

4.2.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1	Single Zone AHU	OA/RA damper actuator inoperable - replace. OA/RA dampers are in a fixed position; OA - 0%; RA - 100%.	223

4.2.3 Proposed HVAC System Replacement

The window AC units serving the administration offices were considered for a HVAC system replacement.

The energy savings and economic analyses for window AC units replacement in Buildings 7178 and 7243 were evaluated previously. For both buildings, the replacements of window AC units were not economically feasible. The window AC units would not likely be economically feasible for HVAC system replacement in Building 222 also.

The SZ AHU is was considered for replacement with a VAV AHU. The VAV AHU would have two zones, one for the liquor store and one for the training center. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHU with VSD will replace the SZ AHU.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- Existing ductwork will be modified to serve the two zones, the liquor store and the training center.

Method of Analysis

The EZDOE computer model for Building 222 was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 222 was used as the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the VAV AHU with a VSD. The VSD controls were set to vary the supply air volume down to 20%. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	260
Annual Electric Demand Savings (\$)	809
Annual Natural Gas Savings (MBtu)	(127)
Total Annual Energy Cost Savings	\$3,431
Investment Cost	\$31,811
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$14,214
Savings-to-Investment Ratio (SIR)	2.03
Simple Payback (yrs)	7.68

4.2.4 Recommendations

The proposed HVAC system replacement is recommended.

4.3 BUILDING 302 (FINANCIAL ADMINISTRATION)

4.3.1 HVAC System Existing Conditions

Building 302 is a 16,138 sq ft, two-story building with an attic space. It was constructed during the early 1900s and has sandstone block foundations and walls. This building has administrative offices on the first and second floors. The attic space is used for storing supplies and has heating only.

The following table describes the HVAC equipment, serving Building 302.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	VAV w/ Reheat	AHU serves entire building, except for area served by AHU-2	Fair condition, except for noisy fan bearing.
AHU-2	SZ	AHU serves an office / storage room (14' x 25') on the 1st floor. Originally used for a computer room.	Fair condition
ACCU-1	Air Cooled Condensing Unit	25 Ton ACCU serves AHU-1 DX coil	Good condition
ACCU-2	Air Cooled Condensing Unit	Small ACCU serves AHU-2 DX coil	Good condition
UH-1 thru UH-4	HW Unit Heaters	UH-1 through UH-4 serve the attic storage/supply area	Good condition
BLR-1	HW Boiler	600,000 BTUH (output) Boiler serves AHU-1, AHU-2 and UHs	Fair condition

4.3.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1	VAV w/ Reheat	Fan bearing near fan pulley is noisy; replace both fan bearings	91

4.3.3 Proposed HVAC System Replacement

The HVAC systems in building 302 are not recommended for replacement. Their existing condition is fair to good. The VAV w/ Reheat AHU is an efficient system and should not be replaced.

4.3.4 Recommendations

The HVAC system component for repair is recommended.

4.4 BUILDING 313 (CIVIL PERSONNEL ADMINISTRATION)

4.4.1 HVAC System Existing Conditions

Building 313 is a 6,222 sq ft, one-story building constructed with face brick and concrete block. It is an administrative office building. The following table describes the HVAC equipment, serving Building 313.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ w/ Duct Furnance	SZ AHU with Duct Furnance and DX cooling coil serves entire building	Fair condition
ACCU-1	Air Cooled Condensing Unit	12 Ton ACCU serves AHU-1 DX coil	Poor condition - condenser coil fins are damaged

4.4.2 HVAC System Components for Repair

The SZ HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
ACCU-1	Air Cooled Condensing Unit	ACCU condenser coil fins are damaged; clean and repair coil fins, provide protective screen over coil fins	797

4.4.3 Proposed HVAC System Replacement

The HVAC system serving building 313 is not recommended for replacement.

4.4.4 Recommendations

The HVAC system component for repair is recommended.



4.5 BUILDING 500 (POST HEADQUARTERS)

4.5.1 HVAC System Existing Conditions

Building 500 is a 65,450 sq ft, three-story building with a conditioned basement. It was constructed during the early 1900s and has sandstone block foundations and walls. The building has administrative offices throughout, with a small video communications center. The building is served by water source heat pumps that provide heating and cooling throughout (except the video communications center which has a separate HVAC system).

The heat pump system description is similar to Building 200. The problems encountered with this system are also similar to Building 200. See Section 4.1.1 for detailed information on the heat pump system existing conditions.

4.5.2 HVAC System Components for Repair

The HVAC system components were observed to be in good condition and operating at the time of the field survey.

4.5.3 Proposed HVAC System Replacement

The existing heat pump system was installed 9 years ago, and was not considered for a replacement HVAC system.

4.5.4 Recommendations

The problems associated with the water source heat pump system can be grouped into three categories:

- Misuse of the water source heat pumps by building users.
- Intensive maintenance required for water source heat pump system operation.
- Lack of system controls to maintain proper water source heat pump system operation.

The water source heat pump system problems could be alleviated by implementing the following:

- Provide building user training for heat pump operation.
- Continue regular maintenance and replace failed heat pumps with quality heat pumps.

- Install DDC system controls to monitor water source heat pump system operation and water source temperature, and provide alarms to indicate when the system shuts down or when the water source temperature is out of proper range. Additionally, automatic control valves could be installed at strategic locations on the condenser water piping. If a break occurs in the condenser water piping system, the control valves would close automatically and retain most of the propylene-water mixture.

The water source heat pump system is being evaluated to be upgraded with DDC controls as part of the installation of a UMCS.

4.6 BUILDING 509 (ADMINISTRATION GENERAL PURPOSE)

4.6.1 HVAC System Existing Conditions

Building 509 is a 10,110 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900s and has sandstone block foundations and walls. The building has administrative offices throughout, and is served by water source heat pumps that provide heating and cooling.

The heat pump system description is similar to Building 200. The problems encountered with this system are also similar to Building 200. See Section 4.1.1 for detailed information on the heat pump system existing conditions.

4.6.2 HVAC System Components for Repair

The HVAC system components were observed to be in good condition and operating at the time of the field survey.

4.6.3 Proposed HVAC System Replacement

The existing heat pump system was installed 9 years ago, and was not considered for a replacement HVAC system.

4.6.4 Recommendations

The problems associated with the water source heat pump system can be grouped into three categories:

- Misuse of the water source heat pumps by building users.
- Intensive maintenance required for water source heat pump system operation.
- Lack of system controls to maintain proper water source heat pump system operation.

The water source heat pump system problems could be alleviated by implementing the following:

- Provide building user training for heat pump operation.
- Continue regular maintenance and replace failed heat pumps with quality heat pumps.

- Install DDC system controls to monitor water source heat pump system operation and water source temperature, and provide alarms to indicate when the system shuts down or when the water source temperature is out of proper range. Additionally, automatic control valves could be installed at strategic locations on the condenser water piping. If a break occurs in the condenser water piping system, the control valves would close automatically and retain most of the propylene-water mixture.

The water source heat pump system is being evaluated to be upgraded with DDC controls as part of the installation of a UMCS.

4.7 BUILDING 5000 (FIRE STATION)

4.7.1 HVAC System Existing Conditions

Building 5000 is a 8,400 sq ft, one-story building constructed in 1975. A new 2,720 sq ft addition is currently being built. The new addition will facilitate the handling of hazardous materials. This study is concerned only with the upgrade of HVAC systems in the original building. The original building is divided into two functional areas, an administrative office/living quarters area (4,600 sq ft) and a vehicle maintenance bay area (3,800 sq ft).

The following table describes the HVAC equipment, serving Building 5000.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	5 zone MZ serves the admin. office/living quarters area; 4,155 cfm at 5 hp	Fair condition
AHU-2	H&V	H&V serves the vehicle maintenance bay; 3,840 cfm at 1.5 hp	Fair condition
RAD-1	Infrared Radiant Heater (gas-fired)	Two IR heaters serve the vehicle maintenance bay.	Good condition
ACCU-1	Air Cooled Condensing Unit	10 Ton ACCU serves AHU-1 DX coil	Poor condition (per interview with maintenance personnel)
BLR-1	HW Boiler	600,000 BTUH (output) Boiler serves AHU-1 and AHU-2	Poor condition - rust and corrosion, leaky
HWP-1	HW pump	1/6 hp pump serves BLR-1, AHU-1, and AHU-2	Fair condition

4.7.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition.

The chiller, although appearing to be in fair condition, has had mechanical problems. An interview with maintenance personnel revealed that the original ACCU (15 ton capacity) was replaced with the current ACCU (10 ton capacity). The 10 ton ACCU runs continuously during peak cooling load conditions and appears to be undersized. The increased run time hours for the ACCU have increased the amount of maintenance and repair generally required for this type of equipment. The ACCU is recommended for replacement, not repair.

The boiler has leaky front and rear head plates. The leaking has caused rust and corrosion on the boiler steel jacket. Boiler replacement, not repair, is recommended due to the boiler age, overall condition, and interview with maintenance personnel.

4.7.3 Proposed HVAC System Replacement

The ACCU, HW boiler, and MZ AHU serving Building 5000 were considered for replacement.

The MZ AHU will be replaced with three furnace-air conditioning units with DX cooling coils. The supply air ductwork will be modified to serve three zones instead of the existing five zones. The new zones will include:

- Zone 1 - Exterior perimeter zone along the south wall and half of west wall (Office area and bedroom area).
- Zone 2 - Exterior perimeter zone along the north wall and half of west wall (Dayroom and kitchen area).
- Zone 3 - Interior zone (Communications center, laboratory-storage area, and toilets).

The existing ACCU will be replaced with three ACCUs each serving the furnace-air conditioning units. ACCU-1 (serving Zone 1) will have a capacity of 5 tons. ACCU-2 (serving Zone 2) will have a capacity of 6 tons. ACCU-3 (serving Zone 3) will have a capacity of 4 tons.

The existing boiler will be replaced with a small modular boiler and will serve the H&V Unit only. The new boiler will have a output capacity of 325,000 Btuh and a minimum efficiency of 85%. The HW pump will be down-sized, and pump motor will be approximately 1/3 hp.

The H&V Unit serving the vehicle maintenance bay was not considered for replacement. The vehicle maintenance bay is heated by gas-fired IR heaters also, and the H&V Unit is used intermittently.

Method of Analysis

The approach used for calculating energy savings included using the EZDOE computer program to simulate the area of Building 5000 served by the MZ AHU. The analysis proceeded as follows:

- A baseline computer model was developed for the area of Building 5000 served by the MZ AHU. The area was divided into three zones, two perimeter zones and one interior zone.
- The baseline computer model was modified to include the HVAC replacement system - the furnace air conditioning systems. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
 - The MZ AHU (4,155 cfm, 233,300 Btuh heating coil, and 120,000 Btuh cooling coil) was replaced with three furnace air conditioners, each serving one of

three zones; Zone 1 - 2,300 cfm, 80,000 Btuh furnace, and 60,000 Btuh DX coil; Zone 2 - 2,900 cfm, 100,000 Btuh furnace, and 72,000 Btuh DX coil; and Zone 3 - 1,700 cfm, 60,000 Btuh furnace, and 48,000 Btuh DX coil.

- Combustion efficiencies for the pulse-combustion type furnaces were input at 94%.
- The MZ AHU design OA of 1,450 cfm was reduced to a total OA quantity of 525 cfm for all three furnace air conditioners (200 cfm for Zone 1; 150 cfm for Zone 2; and 175 cfm for Zone 3). Total occupancy for all zones is approximately 15 people.
- Combustion efficiencies for a smaller HW boiler were input at 85%.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacements are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (kWh)	82
Annual Electric Demand Savings (\$)	(47)
Annual Natural Gas Savings (MBtu)	196
Total Annual Energy Cost Savings	\$1,752
Investment Cost	\$41,284
Annual Maintenance Cost Savings	\$652
Non-recurring Cost Savings	\$72,986
Savings-to-Investment Ratio (SIR)	2.48
Simple Payback (yrs)	6.82

4.7.4 Recommendations

The proposed HVAC system replacement is recommended.

4.8 BUILDING 7178 (VEHICLE MAINTENANCE ADMINISTRATION)

4.8.1 HVAC System Existing Conditions

Building 7178 is a 2,480 sq ft, one-story, single room building. The building was built in the mid-1970s, using concrete block construction. The building has an administrative office area and a work bench area, all in one open room without dividing walls.

The following table describes the HVAC equipment, serving Building 7178.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1	Gas-fired Unit Heater	Gas-fired UH provides heating for the northside of the building.	Good condition
UH-1	Gas-fired Unit Heater	Gas-fired UH provides heating for the southside of the building.	Good condition
WAC-1, WAC-2, WAC-3	Window Air Conditioning Unit	Three WACs serve the entire building; they are mounted in the south wall window openings (250 cfm each)	Fair condition

4.8.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.8.3 Proposed HVAC System Replacement

The three WACs serving Building 7178 were considered for replacement. The WACs will be replaced with a cooling-only SZ AHU with DX coil. The SZ AHU will be installed (ceiling-mounted) at the center of south wall. A supply air ductwork will be run straight out from the SZ AHU at the center of the building. Supply grilles will be connected directly to the supply air ductwork. An ACCU will be installed on the roof directly above the SZ AHU.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7243 HVAC system replacement was used to evaluate the energy savings. The HVAC system replacement for Building 7178 is similar to Building 7243. The energy savings from Building 7243 were prorated on a square foot basis to Building 7178.

The analysis proceeded as follows:

- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	52
Annual Electric Demand Savings (\$)	826
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	\$1,454
Investment Cost	\$12,511
Annual Maintenance Cost Savings	(\$141)
Non-recurring Cost Savings	\$4,071
Savings-to-Investment Ratio (SIR)	1.89
Simple Payback (yrs)	8.25

4.8.4 Recommendations

The proposed HVAC system replacement is not recommended.

4.9 BUILDING 7636 (REGIMENTAL HEADQUARTERS)

4.9.1 HVAC System Existing Conditions

Building 7636 is a 9,850 sq ft, two-story building with a conditioned basement. The building was built in the mid-1970's, constructed of face brick and concrete block. The building has administrative offices throughout, with a conference room in the basement.

The following table describes the HVAC equipment serving Building 7636.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-25	Fan Coil Unit	Dual temperature FCs provide heating and cooling. FCs are located along the building perimeter on the basement, 1st, and 2nd floors.	Fair condition
AHU-1	SZ	SZ AHU with combination heating/cooling coil provides fresh air to the interior zones of the building on the basement, 1st, and 2nd floors	Fair condition
RAD-1	Finned tube baseboard radiation	Finned tube baseboard radiation provides heat to entry ways, stairwells, and a storage area in the basement	Fair condition
BLR-1	HW Boiler	360,000 BTUH (output) boiler serves FCs, AHU-1, and RAD-1. 2-1/2" HW temperature control valve (3-way) is leaking, has corroded actuator.	Fair condition 3-way Control Valve - poor condition
HWP-1	HW Pump	3/4 hp HW pump serves finned tube baseboard radiation system.	HW pump - fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	Chiller serves the FCs and AHU-1	Fair condition
CWP-1	CW Pump	5 hp CW pump serves the FCs and AHU-1	Fair condition

4.9.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
BLR-1	HW Boiler	3-way control valve on the HW system is disabled; replace 2-1/2" three-way control valve	1,050

4.9.3 Proposed HVAC System Replacement

The HVAC systems in Building 7636 are not recommended for replacement.

4.9.4 Recommendations

The HVAC system component for repair is recommended.

4.10 BUILDING 8056 (DET DAY ROOM)

4.10.1 HVAC System Existing Conditions

Building 8056 is a 2,100 sq ft, one-story building. The building was constructed in the mid-1970's using face brick and concrete block. The building has two small administration offices, a mail distribution area, a game room, a television viewing room, two latrines, and two storage closets.

The following table describes the HVAC equipment serving Building 8056.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU with steam heating coil and chilled water cooling coil serves the entire building (2,770 cfm at 1-1/2 hp)	Fair condition
CDP-1	Steam condensate pump	3/4 hp condensate pump - pumps condensate from SZ AHU to steam condensate piping system.	Poor condition - does not operate
	Steam and Chilled Water	Steam is provided by a Central Boiler Plant; Chilled Water is provided by a Central Chiller Plant	

4.10.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to poor condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
CDP-1	Steam condensate pump	3/4 hp condensate pump does not operate; replace pump and motor	744

4.10.3 Proposed HVAC System Replacement

The HVAC system was not considered for replacement.

4.10.4 Recommendations

The HVAC system component for repair is recommended.

4.11 BUILDING 7243 (ADMINISTRATION AND SUPPLY)

4.11.1 HVAC System Existing Conditions

Building 7243 is a 17,830 sq ft, one-story building. The original building (13,030 sq ft), built in 1958, is constructed of face brick and concrete block. A 4,800 sq ft addition was added in 1982 using similar construction materials. The building is divided into six company administration and supply units, each one being identical except for the addition.

The entire original building is heated by perimeter radiation. The original building administration areas are cooled by WACs. The original building supply areas have ventilation exhaust fans, and do not have cooling. The addition administration areas are heated and cooled by FC units. The addition supply area is heated by a H&V unit and a UH.

The following table describes the HVAC equipment serving Building 7243.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the original building	Fair condition
WAC-1 through WAC-15	Window Air Conditioning Unit	Fifteen WACs serve the original building administration areas (three per area); they are mounted in the north wall window openings; approx. 250 cfm each	Fair condition
EF-1 through EF-5	Exhaust Fan	Five EFs serve the supply areas of the original building to provide ventilation air	Fair condition
FC-1 through FC-4	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to the addition administration area.	Fair condition
H&V-1	H&V Unit	One H&V Unit provides heating to the addition supply area	Fair condition
UH-1	Unit Heater	Unit heater provides heating in storage room of addition supply area	Fair condition
BLR-1	HW Boiler	850,000 BTUH (output) boiler serves RAD-1, FCs, H&V-1, and UH-1.	Good condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Good condition
HWP-2	HW pump	1/2 hp pump serves H&V-1 and UH-1	Good condition
CWP-1	CW pump	1/2 hp pump serves Fcs; Central chiller plant is the source of chilled water for cooling.	Fair condition

4.11.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.11.3 Proposed HVAC System Replacement

The fifteen WACs serving the administration office areas of the original building were considered to be replaced with five SZ AHUs with cooling coils (cooling only), each serving one of five zones. The five zones are the five administration areas in the original building. The following HVAC equipment, materials, and labor will be included in the system replacement:

- SZ AHUs will be installed (floor-mounted) in the supply area.
- Supply air and return air ductwork will be installed to serve the office areas.
- OA ductwork will be installed to provide outside air to the SZ AHUs.
- CW supply and return piping will be routed to each SZ AHU.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7243 except for the HVAC system. The analysis proceeded as follows:

- The computer model for Building 8021 was modified to include the existing WACs that provide cooling only; this model was used as the baseline computer model for Building 7243. The baseline model included the following parameters for the WACs:
 - Cooling EIR is 73%;
 - Supply air volume is 3,750 cfm.
- The baseline computer model was modified to include the proposed HVAC system replacement - SZ AHUs. The OA and infiltration rates were not changed. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
 - Mechanical efficiency is 85%;
 - Supply air volume is 5,000 cfm;

- Chilled water is supplied by a central chiller plant.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	50
Annual Electric Demand Savings (\$)	790
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	\$1,390
Investment Cost	\$43,596
Annual Maintenance Cost Savings	(\$704)
Non-recurring Cost Savings	\$19,638
Savings-to-Investment Ratio (SIR)	0.64
Simple Payback (yrs)	26.13

4.11.4 Recommendations

The HVAC systems are not recommended for replacement or repair.



4.12 BUILDING 7432 (ADMINISTRATION AND SUPPLY)

4.12.1 HVAC System Existing Conditions

Building 7432 is a 23,680 sq ft, one-story building. The building was built in 1986 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are heated and cooled by FCs. The building supply areas are heated by H&V units.

The following table describes the HVAC equipment serving Building 7432.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-20	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to each of the administration areas; there are a total of 20 FCs serving the building.	Good condition
H&V-1	H&V Unit	One H&V Unit provides heating to each of the supply areas; there are a total of 5 H&Vs serving the building.	Good condition
CH-1	Reciprocating w/ Air Cooled Cond.	20 Ton chiller serves FCs	Good condition
BLR-1	HW Boiler	895,000 BTUH (output) boiler serves FCs and H&Vs	Good condition
HWP-1	HW pump	5 hp pump serves BLR-1, FCs, and H&Vs	Fair condition
CWP-1	CW pump	3 hp pump serves CH-1 and FCs	Good condition

4.12.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.12.3 Proposed HVAC System Replacement

The HVAC systems in Building 7432 were not considered for replacement.

4.12.4 Recommendations

The HVAC system is not recommended for repair or replacement.



4.13 BUILDING 7602 (ADMINISTRATION AND SUPPLY)

4.13.1 HVAC System Existing Conditions

Building 7602 is a 13,520 sq ft, one-story building. The building was built in 1958 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical.

The administration areas are cooled by small SZ AHUs. The entire building is heated by perimeter radiation units. The following table describes the HVAC equipment serving Building 7602.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building	Fair condition
AHU-1 through AHU-5	SZ	Five SZ AHUs with cooling coils serve the administration office areas of the building (940 cfm at 1/2 hp)	Poor condition - cooling coils and piping at coils are damaged and leaking
CH-1	Reciprocating w/ Air Cooled Cond.	15 Ton chiller serves SZ AHUs	Fair condition
BLR-1	HW Boiler	800,000 BTUH (output) boiler serves RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves BLR-1 and RAD-1	Fair condition
CWP-1	CW pump	1 hp pump serves CH-1 and SZ AHUs	Fair condition

4.13.2 HVAC System Components for Repair

The HVAC system components for RAD-1, CH-1, BLR-1, HWP-1, and CWP-1 were observed to be in fair condition and are not in need of repair. The SZ AHUs were observed to be generally in poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coils are damaged and leaky; replace five - 2 row, 30"x 30" cooling coils	3,077
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coil piping is leaky; replace approx. 90 ft. of 1.25" piping and pipe insulation	837
Total Repair Cost			3,914

4.13.3 Proposed HVAC System Replacement

The SZ AHUs serving the administration areas of Building 7602 were considered for replacement. The SZ AHUs will be replaced with energy efficient SZ AHUs. The following HVAC equipment, materials, and labor will be included in the system replacement:

- SZ AHU.
- Electric thermostat to cycle SZ AHU supply fan.
- Flushing out of existing CW piping system to remove sludge build-up.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7602 except for the HVAC system. The analysis proceeded as follows:

- The computer model for Building 8021 was modified to include the existing cooling-only SZ AHUs; this model was used as the baseline computer model for Building 7602. The baseline model included the following parameters for the SZ AHUs:
 - SZ AHU fans run continuously.
 - Mechanical efficiency is 75%.
 - Supply air volume is 4,700 cfm.
- The baseline computer model was modified to include the proposed HVAC system replacement - SZ AHUs. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
 - SZ AHU fans are cycled on as needed.
 - Mechanical efficiency is 85%.
 - Supply air volume is 5,000 cfm.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	25
Annual Electric Demand Savings (\$)	213
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	\$515
Investment Cost	\$24,083
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$20,550
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.62

4.13.4 Recommendations

The HVAC system components for repair are recommended.



4.14 BUILDING 7608 (ADMINISTRATION AND SUPPLY)

4.14.1 HVAC System Existing Conditions

Building 7608 is a 13,520 sq ft, one-story building. The building was built in 1958 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are cooled by small SZ AHUs. The entire building is heated by perimeter radiation units.

The following table describes the HVAC equipment serving Building 7608.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building	Fair condition
AHU-1 through AHU-5	SZ	Five SZ AHUs with cooling coils serve the administration office areas of the building (940 cfm at 1/2 hp)	Poor condition - cooling coils and piping at coils are damaged and leaking
CH-1	Reciprocating w/ Air Cooled Cond.	15 Ton chiller serves SZ AHUs	Fair condition
BLR-1	HW Boiler	800,000 BTUH (output) boiler serves RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves BLR-1 and RAD-1	Fair condition
CWP-1	CW pump	1 hp pump serves CH-1 and SZ AHUs	Fair condition

4.14.2 HVAC System Components for Repair

The HVAC system components for RAD-1, CH-1, BLR-1, HWP-1, and CWP-1 were observed to be in fair condition and are not in need of repair. The SZ AHUs were observed to be generally in poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coils are damaged and leaky; replace five - 2 row, 30"x 30" cooling coils	3,077
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coil piping is leaky; replace approx. 90 ft. of 1.25" piping and pipe insulation	837
Total Repair Cost			3,914

4.14.3 Proposed HVAC System Replacement

The SZ AHUs serving the administration areas of Building 7608 were considered for replacement. The SZ AHUs will be replaced with energy efficient SZ AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7608. The analysis, energy savings, and system replacement cost for Building 7608 are taken from Building 7602. Building 7602 is identical to Building 7608.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	25
Annual Electric Demand Savings (\$)	213
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	\$515
Investment Cost	\$24,083
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$20,550
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.62

4.14.4 Recommendations

The HVAC system components for repair are recommended.

4.15 BUILDING 7652 (ADMINISTRATION AND SUPPLY)

4.15.1 HVAC System Existing Conditions

Building 7652 is a 13,520 sq ft, one-story building. The building was built in 1958 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are cooled by small SZ AHUs. The entire building is heated by perimeter radiation units.

The following table describes the HVAC equipment serving Building 7652.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building	Fair condition
AHU-1 through AHU-5	SZ	Five SZ AHUs with cooling coils serve the administration office areas of the building (940 cfm at 1/2 hp)	Poor condition - cooling coils and piping at coils are damaged and leaking
CH-1	Reciprocating w/ Air Cooled Cond.	15 Ton chiller serves SZ AHUs	Good condition
BLR-1	HW Boiler	800,000 BTUH (output) boiler serves RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves BLR-1 and RAD-1	Fair condition
CWP-1	CW pump	1 hp pump serves CH-1 and SZ AHUs	Fair condition

4.15.2 HVAC System Components for Repair

The HVAC system components for RAD-1, CH-1, BLR-1, HWP-1, and CWP-1 were observed to be in fair condition and are not in need of repair. The SZ AHUs were observed to be generally in poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coils are damaged and leaky; replace five - 2 row, 30"x 30" cooling coils	3,077
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coil piping is leaky; replace approx. 90 ft. of 1.25" piping and pipe insulation	837
Total Repair Cost			3,914

4.15.3 Proposed HVAC System Replacement

The SZ AHUs serving the administration areas of building 7652 were considered for replacement. The SZ AHUs will be replaced with energy efficient SZ AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7608. The analysis, energy savings, and system replacement cost for Building 7652 are taken from Building 7602. Building 7602 is identical to Building 7652.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	25
Annual Electric Demand Savings (\$)	213
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	\$515
Investment Cost	\$24,083
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$20,550
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.62

4.15.4 Recommendations

The HVAC system components for repair are recommended.

4.16 BUILDING 7658 (ADMINISTRATION AND SUPPLY)

4.16.1 HVAC System Existing Conditions

Building 7658 is a 13,520 sq ft, one-story building. The building was built in 1958 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are cooled by small SZ AHUs. The entire building is heated by perimeter radiation units.

The following table describes the HVAC equipment serving Building 7658.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building	Fair condition
AHU-1 through AHU-5	SZ	Five SZ AHUs with cooling coils serve the administration office areas of the building (940 cfm at 1/2 hp)	Poor condition - cooling coils and piping at coils are damaged and leaking
CH-1	Reciprocating w/ Air Cooled Cond.	15 Ton chiller serves SZ AHUs	Good condition
BLR-1	HW Boiler	800,000 BTUH (output) boiler serves RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves BLR-1 and RAD-1	Fair condition
CWP-1	CW pump	1 hp pump serves CH-1 and SZ AHUs	Fair condition

4.16.2 HVAC System Components for Repair

The HVAC system components for RAD-1, CH-1, BLR-1, HWP-1, and CWP-1 were observed to be in fair condition and are not in need of repair. The SZ AHUs were observed to be generally in poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coils are damaged and leaky; replace five - 2 row, 30"x 30" cooling coils	3,077
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coil piping is leaky; replace approx. 90 ft. of 1.25" piping and pipe insulation	837
Total Repair Cost			3,914

4.16.3 Proposed HVAC System Replacement

The SZ AHUs serving the administration areas of building 7658 were considered for replacement. The SZ AHUs will be replaced with energy efficient SZ AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7658. The analysis, energy savings, and system replacement cost for Building 7658 are taken from Building 7602. Building 7602 is identical to Building 7658.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	25
Annual Electric Demand Savings (\$)	213
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	\$515
Investment Cost	\$24,083
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$20,550
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.62

4.16.4 Recommendations

The HVAC system components for repair are recommended.

4.17 BUILDING 8021 (ADMINISTRATION AND SUPPLY)

4.17.1 HVAC System Existing Conditions

Building 8021 is a 23,680 sq ft, one-story building. The building was built in 1975 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are heated and cooled by FCs. The supply areas of the building are heated by H&V units.

The following table describes the HVAC equipment serving Building 8021.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-20	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to each of the administration areas; there are a total of 20 FCs serving the building; 600 cfm to 900 cfm and 1/12 hp each	Fair condition
H&V-1	H&V Unit	One H&V Unit provides heating to each of the supply areas; there are a total of 5 H&Vs serving the building; 2,400 cfm and 1/2 hp each	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp DTWP serves FCs and H&Vs; Summer/Winter changeover valve switches between heating and cooling; Chilled water is provided by Central Chiller Plant	Fair condition
CV-1	Steam/HW converter	Steam/HW converter serves FCs, and H&Vs; Steam provided by Central Boiler Plant	Fair condition

4.17.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.17.3 Proposed HVAC System Replacement

The HVAC systems in Building 8021 were not considered for replacement.

4.17.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.18 BUILDING 8057 (ADMINISTRATION AND SUPPLY)

4.18.1 HVAC System Existing Conditions

Building 8057 is a 23,680 sq ft, one-story building. The building was built in 1975 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are heated and cooled by FCs. The supply areas of the building are heated by H&V units.

The following table describes the HVAC equipment serving Building 8057.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-20	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to each of the administration areas; there are a total of 20 FCs serving the building; 600 cfm to 900 cfm and 1/12 hp each	Fair condition
H&V-1	H&V Unit	One H&V Unit provides heating to each of the supply areas; there are a total of 5 H&Vs serving the building; 2,400 cfm and 1/2 hp each	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp DTWP serves FCs and H&Vs; Summer/Winter changeover valve switches between heating and cooling; Chilled water is provided by Central Chiller Plant	Fair condition
CV-1	Steam/HW converter	Steam/HW converter serves FCs, and H&Vs; Steam provided by Central Boiler Plant	Fair condition

4.18.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.18.3 Proposed HVAC System Replacement

The HVAC systems in Building 8057 were not considered for replacement.

4.18.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.19 BUILDING 227 (ENLISTED BARRACKS W/AS)

4.19.1 HVAC System Existing Conditions

Building 227 is a 32,300 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900's and has sandstone block foundations and walls. This barracks has dormitory rooms on the first and second floors, and a recreation room, laundry facility, and storage area in the basement. The majority of the building is served by MZ AHUs and SZ AHUs, installed in 1975, that provide heating and cooling. Part of the basement is heated by unit heaters, and the vestibules and stairwells are heated by finned tube radiation units.

The following table describes the HVAC equipment serving Building 227.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU serves the east half of the first and second floors of the building; 10,350 cfm at 5 hp	Fair condition
AHU-2	MZ	MZ AHU serves the west half of the first and second floors of the building; 10,250 cfm at 5 hp	Fair condition
AHU-3	SZ	SZ AHU serves the west wing of the basement; 2,800 cfm at 1 hp	Poor condition - 1" CW control valve inoperable
AHU-4	SZ	SZ AHU serves the central area of the basement; 930 cfm at 1 hp	Fair condition
AHU-5	SZ	SZ AHU serves the east wing of the basement; 2,400 cfm at 1 hp	Poor condition - 1-1/2" CW control valve actuator missing
RAD-1	Finned tube radiation	Finned tube radiation provides heating in the vestibules and stairwells	Fair condition
UH-1 and UH-2	Unit Heaters	UH-1 and UH-2 provide heat to storage areas in the basement	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	65 Ton chiller serves the MZ and SZ AHUs	Fair condition
CWP-1	CW pump	3 hp pump serves CH-1, MZ AHUs, and SZ AHUs	Fair condition
BLR-1 and BLR-2	Steam boiler	Steam boilers serve the MZ AHUs, SZ AHUs, RAD-1, and UHs	Fair condition

4.19.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-3	SZ	1" CW control valve actuator missing - replace entire valve	206
AHU-5	SZ	1-1/2" CW control valve actuator inoperable - replace entire valve	300
Total Repair Cost			506

4.19.3 Proposed HVAC System Replacement

The MZ AHUs and SZ AHUs serving Building 227 were considered for replacement with VAV AHUs. The following equipment and materials will be included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the MZ and SZ AHUs.
- Existing ductwork will remain; VAV terminal units will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 409 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 227 is similar to Building 409, and both have similar HVAC systems.

The analysis proceeded as follows:

- The computer model for Building 409 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the VAV AHUs with VSDs. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to Building 227.

- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	1,163
Annual Electric Demand Savings (\$)	1,527
Annual Natural Gas Savings (MBtu)	(852)
Total Annual Energy Cost Savings	\$12,089
Investment Cost	\$111,119
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$70,248
Savings-to-Investment Ratio (SIR)	2.18
Simple Payback (yrs)	7.12

4.19.4 Recommendations

The proposed HVAC system replacement is recommended.

4.20 BUILDING 402 (ENLISTED BARRACKS W/AS)

4.20.1 HVAC System Existing Conditions

Building 402 is a 35,700 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900's and has sandstone block foundations and walls. This barracks has dormitory rooms on the first and second floors, and a recreation room, laundry facility, and storage area in the basement. The first and second floors of the building are served by MZ AHUs, installed in 1975, that provide heating and cooling. The basement is heated by finned tube radiation units, except for a SZ AHU serving the recreation room. The latrines, vestibules, and stairwells are heated by finned tube radiation units.

The following table describes the HVAC equipment serving Building 402.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU serves the north half of the first and second floors of the building; 9,325 cfm at 5 hp	Fair condition
AHU-2	MZ	MZ AHU serves the south half of the first and second floors of the building; 11,800 cfm at 7.5 hp	Fair condition
AHU-3	SZ	SZ AHU serves the north wing of the basement; 1,300 cfm at 1 hp	Poor condition - 1-1/2" CW control valve inoperable
RAD-1	Finned tube radiation	Finned tube radiation provides heating in the latrines, vestibules and stairwells	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	65 Ton chiller serves the MZ AHUs and SZ AHU	Fair condition
CWP-1	CW pump	3 hp pump serves CH-1, MZ AHUs, and SZ AHU	Fair condition
BLR-1 and BLR-2	Steam boiler	Steam boilers serve the MZ AHUs, SZ AHUs, and RAD-1	Fair condition

4.20.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-3	SZ	1-1/2 CW control valve actuator inoperable - replace entire valve	300

4.20.3 Proposed HVAC System Replacement

The MZ AHUs and SZ AHU serving Building 402 were considered for replacement with VAV AHUs with VSDs. The following equipment and materials will be included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the MZ AHUs and SZ AHU.
- Existing ductwork will remain; VAV terminal units (pressure independent) will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 409 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 402 is similar to Building 409, and both have similar HVAC systems. Building 402 is also similar to Building 227. The energy savings calculated for the proposed HVAC system replacement in Building 227 were prorated on a square foot basis to derive the energy savings for Building 402.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	997
Annual Electric Demand Savings (\$)	1,309
Annual Natural Gas Savings (MBtu)	(730)
Total Annual Energy Cost Savings	\$10,362
Investment Cost	\$78,851
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$49,221
Savings-to-Investment Ratio (SIR)	2.52
Simple Payback (yrs)	6.15

4.20.4 Recommendations

The proposed HVAC system replacement is recommended.



4.21 BUILDING 410 (ENLISTED BARRACKS W/AS)

4.21.1 HVAC System Existing Conditions

Building 410 is a 32,880 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900s and has sandstone block foundations and walls. This barracks has dormitory rooms on the first and second floors, and a recreation room, laundry facility, and storage area in the basement. The first and second floors of the building are served by MZ AHUs that provide heating and cooling. The basement is heated by finned tube radiation units and UHs, except for a MZ AHU serving the recreation room and a meeting room. The latrines, vestibules, and stairwells are heated by finned tube radiation units. The majority of the HVAC equipment was installed in 1975.

The following table describes the HVAC equipment serving Building 410.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU serves the north west half of the first and second floors of the building; 12,375 cfm at 7.5 hp	Fair condition
AHU-2	MZ	MZ AHU serves the south east half of the first and second floors of the building; 12,375 cfm at 7.5 hp	Fair condition
AHU-3	MZ	MZ AHU serves the north east wing of the basement and a meeting room; 1,950 cfm at 1 hp	Fair condition
UH-1	Unit Heater	Two UHs serve the north west wing of the basement	Fair condition
UH-2	Unit Heater	Four UHs serve the north east wing of the basement	Fair condition
RAD-1	Finned tube radiation	Finned tube radiation provides heating in the latrines, vestibules and stairwells	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves the MZ AHUs and SZ AHU	Good condition (new)
CWP-1	CW pump	3 hp pump serves CH-1 and MZ AHUs	Fair condition
BLR-1	Steam boiler	Steam boiler serves the MZ AHUs, RAD-1, and UHs	Fair condition

4.21.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.21.3 Proposed HVAC System Replacement

The MZ AHUs serving Building 410 were considered for replacement with VAV AHUs with VSDs. The following equipment and materials will be included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the MZ AHUs.
- Existing ductwork will remain; VAV terminal units (pressure independent) will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 409 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 410 is similar to Buildings 409 and 402, all have similar HVAC systems. The areas served by the AHUs in Building 402 are identical to the areas served by AHUs in Building 410. The energy savings calculated for the proposed HVAC system replacement in Building 227 were prorated on a square foot basis to derive the energy savings for Building 410.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	997
Annual Electric Demand Savings (\$)	1,309
Annual Natural Gas Savings (MBtu)	(730)
Total Annual Energy Cost Savings	\$10,362
Investment Cost	\$77,512
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$51,813
Savings-to-Investment Ratio (SIR)	2.59
Simple Payback (yrs)	5.98

4.21.4 Recommendations

The proposed HVAC system replacement is recommended.

4.22 BUILDING 540 (ENLISTED BARRACKS W/AS)

4.22.1 HVAC System Existing Conditions

Building 540 is a 14,530 sq ft, two-story building. The building was built in 1965 and is constructed of a combination of face brick, wood siding, concrete block. The entire building is served by FCs that provide heating and cooling.

The following table describes the HVAC equipment serving Building 540.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-37	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each room of the barracks. A total of 37 FCs serve the building.	Fair condition
BLR-1	Modular HW Boiler	Six modular HW boilers serve the FCs	Good condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves the MZ AHUs and SZ AHU	Good condition (new)
DTWP-1 and DTWP-2	Dual Temperature Water pump	2 hp pumps serve CH-1, BLR-1, and FCs; one pump is a standby	Good condition

4.22.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.22.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 540 were not considered for HVAC system replacement.

4.22.4 Recommendations

The HVAC systems are not recommended for repair or replacement.



4.23 BUILDING 7404 (ENLISTED BARRACKS W/O DINING)

4.23.1 HVAC System Existing Conditions

Building 7404 is a 50,970 sq ft, three-story building with a partial basement. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building.

Two large MZ AHUs provide cooling to the barracks, and a perimeter radiation system provides heating. The basement area is used as a storage and is heated by the perimeter radiation system (no cooling). The mechanical equipment room is also located in the basement.

The following table describes the HVAC equipment serving Building 7404.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building; RAD-1 is divided into two piping circuits, the west piping circuit and the east piping circuit	Fair condition
AHU-1	MZ	MZ AHU with cooling coil serves the north half of the barracks on the 1st, 2nd, and 3rd floors of the building; (29,135 cfm at 7-1/2 hp)	Fair condition
AHU-2	MZ	MZ AHU with cooling coil serves the south half of the barracks on the 1st, 2nd, and 3rd floors of the building; (28,225 cfm at 7-1/2 hp)	Fair condition
	Chilled Water to the MZ AHUs	Chilled water is provided by a Central Chiller Plant	
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1 and RAD-1; HWP-1 serves the west piping circuit of RAD-1	Fair condition
HWP-2	HW pump	2 hp pump serves BLR-1 and RAD-1; HWP-2 serves the east piping circuit of RAD-1	Fair condition

4.23.2 HVAC System Components for Repair

The HVAC system components for RAD-1, AHU-1, AHU-2, BLR-1, HWP-1, and HWP-2 were observed to be in fair condition and are not in need of repair.

4.23.3 Proposed HVAC System Replacement

The two MZ AHUs serving Building 7404 were considered for conversion to VAV AHUs. The existing MZ AHUs will be modified as follows:

- VSD controllers will be installed on the MZ AHUs to control the supply fan speed.
- Both MZ AHUs have zone dampers for the cold deck only. The hot deck has a perforated plates in place of zone dampers. The pneumatic actuators on the cold deck zone dampers will be retrofitted with electric actuators and VAV terminal unit controllers. The perforated plates on the hot deck will be removed, and the area will be blanked off with sheet metal safig. The retrofitted dampers will vary the airflow rate to each zone.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7810 was used to evaluate energy savings for the proposed HVAC system replacement. Building 7810 is similar to Building 7404 except for the HVAC system. Building 7810 has fan coil units for heating and cooling; Building 7404 has MZ AHUs for cooling and HW perimeter radiation for heating.

The analysis proceeded as follows:

- The computer model for Building 7810 was modified to incorporate the MZ AHUs and HW perimeter radiation. This model was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the MZ AHUs converted to VAV AHUs with VSDs. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	364
Annual Electric Demand Savings (\$)	378
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	\$4,780
Investment Cost	\$26,055
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$0
Savings-to-Investment Ratio (SIR)	2.90
Simple Payback (yrs)	5.45

4.23.4 Recommendations

The proposed HVAC system replacement is recommended.



4.24 BUILDING 7612 (ENLISTED BARRACKS W/O DINING)

4.24.1 HVAC System Existing Conditions

Building 7612 is a 41,890 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement.

Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving Building 7612.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the north half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the south half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Fair condition
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Poor condition - pump seals leaking
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Fair condition
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Fair condition - some rust on pump and piping to pump

4.24.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump is leaking and requires replacement of pump seals	208

4.24.3 Proposed HVAC System Replacement

The FCs and AHUs serving Building 7612 were considered for HVAC system replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 7612 was used as the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the VAV AHUs. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
 - The total OA from ventilation and infiltration is presently 11,400 cfm (SZ AHUs provide 7,000 cfm of OA for ventilation in hallways and 4,400 cfm of OA is from infiltration). The proposed system will reduce OA to a total of 4,300 cfm (3,060 cfm OA ventilation through the VAV AHUs and 1,240 cfm OA from infiltration). The VAV AHUs, serving all areas of the building, will reduce the infiltration by pressurizing the building. There are approximately 150 people in the barracks.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings (\$)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	\$8,881
Investment Cost	\$434,560
Annual Maintenance Cost Savings	\$5,147
Non-recurring Cost Savings	\$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.24.4 Recommendations

The HVAC system component for repair is recommended.

4.25 BUILDING 7614 (ENLISTED BARRACKS W/O DINING)

4.25.1 HVAC System Existing Conditions

Building 7614 is a 41,890 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement. Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving Building 7614.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the north half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the south half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Poor condition - leaky pump seals
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Poor condition - pump seals leaking
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Poor condition - pump seals leaking
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Fair condition - some rust on pump and piping to pump

4.25.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
CWP-1	CW pump	1-1/2 hp pump is leaking and requires replacement of pump seals	208
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump is leaking and requires replacement of pump seals	208
DTWP-4	Dual Temperature Water pump	3 hp pump is leaking and requires replacement of pump seals	209
Total Repair Cost			625

4.25.3 Proposed HVAC System Replacement

The FCs serving Building 7614 were considered for replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7614 is identical to Building 7612. The analysis, energy savings, and system replacement cost for Building 7614 are taken from Building 7612.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings (\$)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	\$8,881
Investment Cost	\$389,740
Annual Maintenance Cost Savings	\$5,147
Non-recurring Cost Savings	\$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.25.4 Recommendations

The HVAC system components for repair are recommended.



4.26 BUILDING 7616 (ENLISTED BARRACKS W/O DINING)

4.26.1 HVAC System Existing Conditions

Building 7616 is a 41,890 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement. Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving building 7616.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the east half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the west half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Fair condition
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Fair condition
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Fair condition

4.26.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.26.3 Proposed HVAC System Replacement

The FCs serving building 7616 were considered for replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7616 is identical to Building 7612. The analysis, energy savings, and system replacement cost for Building 7616 are taken from Building 7612.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings (\$)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	\$8,881
Investment Cost	\$389,740
Annual Maintenance Cost Savings	\$5,147
Non-recurring Cost Savings	\$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.26.4 Recommendations

The proposed HVAC system replacement is not recommended.



4.27 BUILDING 7810 (ENLISTED BARRACKS W/O DINING)

4.27.1 HVAC System Existing Conditions

Building 7810 is a 41,840 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement. Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving Building 7810.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the east half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the west half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Fair condition
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Poor condition - pump seals leaking
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Poor condition - pump seals leaking
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Fair condition

4.27.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the estimated costs for repair.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
DTWP-3	Dual Temperature Water pump	2 hp pump is leaking and requires replacement of pump seals	209
DTWP-4	Dual Temperature Water pump	1-1/2 hp pump is leaking and requires replacement of pump seals	208
Total Repair Cost			417

4.27.3 Proposed HVAC System Replacement

The FCs serving Building 7810 were considered for replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7810 is identical to Building 7612. The analysis, energy savings, and system replacement cost for Building 7810 are taken from Building 7612.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings (\$)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	\$8,881
Investment Cost	\$389,740
Annual Maintenance Cost Savings	\$5,147
Non-recurring Cost Savings	\$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.27.4 Recommendations

The HVAC system components for repair are recommended.



4.28 BUILDING 7814 (ENLISTED BARRACKS W/O DINING)

4.28.1 HVAC System Existing Conditions

Building 7814 is a 41,840 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement. Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving Building 7814.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the east half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the west half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Fair condition
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	Pump is missing; estimate a 2 hp pump for replacement	Poor condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition - exterior of pump very rusted
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Fair condition
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Poor condition - pump bearings are noisy

4.28.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
DTWP-1	Dual Temperature Water pump	2 hp pump is missing and requires installation	1,011
HWP-1	HW pump	1/2 hp pump is noisy and requires replacement of pump bearings and seals	208
Total Repair Cost			1,219

4.28.3 Proposed HVAC System Replacement

The FCs serving building 7814 were considered for replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7814 is identical to Building 7612. The analysis, energy savings, and system replacement cost for Building 7814 are taken from Building 7612.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings (\$)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	\$8,881
Investment Cost	\$389,740
Annual Maintenance Cost Savings	\$5,147
Non-recurring Cost Savings	\$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.28.4 Recommendations

The HVAC system components for repair are recommended.



4.29 BUILDING 7050 (ENLISTED BARRACKS WITH DINING)

4.29.1 HVAC System Existing Conditions

Building 7050 is a 39,680 sq ft, three-story building. The building was built during the mid-1950s and is constructed of concrete block. The barracks are located on the first, second, and third floors of the building. The dining hall and kitchen is located on the first floor level at the south end of the building. The mechanical equipment room is located in the basement. In 1975, a modernization project upgraded the barracks with new HVAC equipment including FCs, CW piping, and ductwork modifications for the SZ and H&V Units. A recent modernization project (within the last three years) has provided new HW boilers, HW pumps, and CW pumps.

Approximately 93 FCs provide cooling to the rooms in the barracks. Perimeter radiation provides heating to the rooms in the barracks. A SZ AHU provides heating and cooling to the dining hall. A H&V Unit provides heating to the kitchen area and make-up air for the kitchen exhaust hood.

The following table describes the HVAC equipment serving Building 7050.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-93	Two-pipe fan coil	FCs provide cooling only to the rooms in the barracks. A total of 93 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU provides heating and cooling to the dining hall	Fair condition
H&V-1	H&V Unit	H&V Unit provides heating and make-up air to the kitchen area	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating throughout the building	Fair condition
	Chilled Water to the FCs and SZ AHU	Chilled water is provided by a Central Chiller Plant	
BLR-1 and BLR-2	HW Boiler	HW boilers serve AHU-1, FCs, and RAD-1 (1,749,000 Btuh output each)	Good condition
BLR-3	Steam Boiler	Steam boiler serves H&V-1 and kitchen equipment (1,204,800 Btuh output)	Good condition
BP-1	Boiler pump	1-1/2 hp pump serves BLR-1	Good condition
BP-2	Boiler pump	1-1/2 hp pump serves BLR-2	Good condition
CWP-1	Chilled Water pump	2 hp pump serves chilled water system FCs	Good condition
CWP-2	Chilled Water pump	2 hp pump serves chilled water system FCs	Good condition
HWP-1	HW pump	3/4 hp pump serves RAD-1 (perimeter radiation units)	Good condition

4.29.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.29.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 7050 were not considered for replacement. The replacement of the cooling-only FC system with a cooling-only VAV system would not be practical economically. Energy savings would only be accrued for the cooling season (5 months out of the year). The construction cost for VAV AHUs and ductwork would be very high compared to the amount of energy dollar savings.

4.29.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.30 BUILDING 7053 (ENLISTED BARRACKS W/O DINING)

4.30.1 HVAC System Existing Conditions

Building 7053 is a 39,680 sq ft, three-story building. The building was built during the mid-1950s and is constructed of concrete block. The barracks are located on the first, second, and third floors of the building. The former dining hall and kitchen, located on the first floor level at the south end of the building, is used as a storage area. The mechanical equipment room is located in the basement. In 1975, a modernization project upgraded the barracks with new HVAC equipment including FCs and CW piping. A recent modernization project (within the last three years) has provided new HW boilers, HW pumps, and CW pumps.

Approximately 93 FCs provide cooling to the rooms in the barracks, and perimeter radiation units provide heating throughout the barracks. The following table describes the HVAC equipment serving Building 7053.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-93	Two-pipe fan coil	FCs provide cooling to rooms in the barracks. A total of 93 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating throughout the entire building	Fair condition
	Chilled Water to the FCs and SZ AHU	Chilled water is provided by a Central Chiller Plant	
BLR-1 and BLR-2	HW Boiler	HW boilers serve RAD-1 (1,749,000 Btuh output each)	Good condition
BP-1	Boiler pump	1-1/2 hp pump serves BLR-1	Good condition
BP-2	Boiler pump	1-1/2 hp pump serves BLR-2	Good condition
CWP-1	Chilled Water pump	2 hp pump serves chilled water system FCs	Good condition
CWP-2	Chilled Water pump	2 hp pump serves chilled water system FCs	Good condition
HWP-1	HW pump	3/4 hp pump serves RAD-1 (perimeter radiation units)	Good condition

4.30.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.30.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 7053 were not considered for replacement. The replacement of the cooling-only FC system with a cooling-only VAV system would not be practical economically. Energy savings would only be accrued for the cooling season (5 months out of the year). The construction cost for VAV AHUs and ductwork would be very high compared to the amount of energy dollar savings.

4.30.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.31 BUILDINGS 8002, 8012, 8038, 8042, AND 8052 (ENLISTED BARRACKS W/O DINING)

4.31.1 HVAC System Existing Conditions

These Enlisted Barracks are 22,700 sq ft, three-story buildings. The buildings were built in 1975 and constructed of face brick and concrete block. The barracks rooms are located on the first, second, and third floors of the building. The mechanical equipment room is located on the first floor level. Approximately 72 FCs provide heating and cooling to the rooms and hallways in each barracks.

The following table describes the HVAC equipment serving these buildings.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-72	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room, hallways, and dayrooms in the barracks. A total of 72 FCs serve the building.	Fair to poor condition - some control valves are leaky and most have been removed; some fan switches are broken and inoperable
	Chilled Water to the FCs	Chilled water is provided by a Central Chiller Plant	
CV-1	Steam/HW converter	CV-1 provides HW to the FCs; steam is provided by a Central Boiler Plant	Poor condition - exterior rust and corrosion from leaking pipes, insulation damaged and missing
DTWP-1	Dual Temperature Water pump	5 hp pump serves dual temperature water system FCs	Poor condition - exterior rust and corrosion, insulation damaged and missing

4.31.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor condition. Control valves on the FCs in the hallways were observed to be leaky and corroded. A controls renovation project has removed the control valves from the FCs in the dormitory rooms and dayrooms. The control valves on the FCs in the hallways remained. The three speed fan switches on FCs in the dayrooms are broken or damaged. These HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
FC-1 through FC-72	Two-pipe fan coil	1/2" control valves leaking, corroded - replace 48 control valves	9,425
FC-1 through FC-72	Two-pipe fan coil	3 speed fan switches on FCs in dayrooms are broken or damaged - replace 48 fan switches	1,710
Total Repair Cost			11,135

4.31.3 Proposed HVAC System Replacement

A proposed HVAC system replacement was considered, but would not be feasible given the architectural design of the building. This system replacement is described as follows:

- Four SZ AHUs per floor ducted to 16 dormitory rooms (4 rooms per SZ AHU).
- SZ AHUs installed in dayrooms converted to MERs.
- Dual temperature water piped from existing MER up through floors and through hallways to MERs.

The MERs, placed in the dayrooms, would take up most of the space and eliminate functional use of dayrooms. Establishing a dormitory room as a MER on each floor would reduce available space for quarters. A building addition could be constructed to provide space for MERs. These proposed MER locations would not be practical or feasible for this type of barracks. Individual room fan coils are the only practical way to condition these buildings.

4.31.4 Recommendations

The HVAC system components for repair are recommended.

4.32 BUILDINGS 8014, 8040, 8048, AND 8050 (ENLISTED BARRACKS W/O DINING)

4.32.1 HVAC System Existing Conditions

These Enlisted Barracks are 11,550 sq ft, three-story buildings. The buildings were built in 1975 and constructed of face brick and concrete block. The barracks rooms are located on the first, second, and third floors of the building. The mechanical equipment room is located on the first floor level. Approximately 36 FCs provide heating and cooling to the rooms and hallways in each barracks.

The following table describes the HVAC equipment serving these buildings.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-36	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room, hallways, and dayrooms in the barracks. A total of 36 FCs serve the building.	Fair to poor condition - some control valves are leaky and some have been removed; some fan switches are broken and inoperable
	Chilled Water to the FCs	Chilled water is provided by a Central Chiller Plant	
CV-1	Steam/HW converter	CV-1 provides HW to the FCs; steam is provided by a Central Boiler Plant	Poor condition - exterior rust and corrosion from leaking pipes, insulation damaged and missing
DTWP-1	Dual Temperature Water pump	1.5 hp pump serves dual temperature water system FCs	Poor condition - exterior rust and corrosion, insulation damaged and missing

4.32.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor condition. Control valves on the FCs in the hallways were observed to be leaky and corroded. A controls renovation project has removed the control valves from the FCs in the dormitory rooms and dayrooms. The control valves on the FCs in the hallways remained. The three speed fan switches on FCs in the dayrooms are broken or damaged. These HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
FC-1 through FC-36	Two-pipe fan coil	1/2" control valves leaking, corroded - replace 24 control valves	3,772
FC-1 through FC-36	Two-pipe fan coil	3 speed fan switches on FCs in dayrooms are broken or damaged - replace 24 fan switches	684
Total Repair Cost			4,456

4.32.3 Proposed HVAC System Replacement

A proposed HVAC system replacement was considered, but would not be feasible given the architectural design of the building. This system replacement is described as follows:

- Two SZ AHUs per floor ducted to 8 dormitory rooms (4 rooms per SZ AHU).
- SZ AHUs installed in dayrooms converted to MERs.
- Dual temperature water piped from existing MER up through floors and through hallways to MERs.

The MERs, placed in the dayrooms, would take up most of the space and eliminate functional use of dayrooms. Establishing a dormitory room as a MER on each floor would reduce available space for quarters. A building addition could be constructed to provide space for MERs. These proposed MER locations would not be practical or feasible for this type of barracks. Individual room fan coils are the only practical way to condition these buildings.

4.32.4 Recommendations

The HVAC system components for repair are recommended.

4.33 BUILDING 7806 (BATTALION HEADQUARTERS)

4.33.1 HVAC System Existing Conditions

Building 7806 is a 13,490 sq ft, one-story building. The building was built in 1958, originally as a Five Company Mess Hall, and is constructed of face brick and concrete block. It was renovated in 1968 into a Battalion Headquarters building. The building is heated and cooled by two SZ AHUs. The entire building is heated by perimeter radiation units.

The following table describes the HVAC equipment serving Building 7806.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the south half of the building; 6,400 cfm at 3 hp	Poor condition
AHU-2	SZ	SZ AHU provides heating and cooling to the north half of the building; 6,600 cfm at 3 hp	Poor condition
RAD-1	HW baseboard radiation	Perimeter radiation provides heating throughout the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1 and SZ AHUs	Fair condition
BLR-1	STM Boiler	STM boiler serves SZ AHUs and RAD-1	Fair condition
CV-1	STM/HW Converter	CV-1 provides HW to RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves CV-1 and RAD-1	Fair condition

4.33.2 HVAC System Components for Repair

The HVAC system components for building 7806 were observed to be generally in fair condition and are not in need of repair.

4.33.3 Proposed HVAC System Replacement

The SZ AHUs were considered for replacement with VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts; the existing ductwork will remain.

- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7656 was used to evaluate energy savings for the proposed HVAC system replacement. Building 7656 is similar to Building 7806 except for the HVAC system. Building 7656 has MZ AHUs for heating and cooling; Building 7806 has SZ AHUs for heating and cooling.

The analysis proceeded as follows:

- The computer model for Building 7656 was modified to incorporate the SZ AHUs. This model was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement systems - the VAV AHUs with a VSDs. The VSD controls were set to vary the supply air volume down to 20%. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	263
Annual Electric Demand Savings (\$)	735
Annual Natural Gas Savings (MBtu)	(95)
Total Annual Energy Cost Savings	\$3,526
Investment Cost	\$34,973
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$23,323
Savings-to-Investment Ratio (SIR)	2.13
Simple Payback (yrs)	7.45

4.33.4 Recommendations

The proposed HVAC system replacement is recommended.



4.34 BUILDING 8025 (BATTALION ADMINISTRATION AND CLASSROOMS)

4.34.1 HVAC System Existing Conditions

Building 8025 is a 12,000 sq ft, one-story building. The building was built in 1975 and is constructed of face brick and concrete block. Three MZ AHUs provide cooling to two large classrooms and administrative offices. The entire building is heated by HW perimeter radiation units.

The following table describes the HVAC equipment serving Building 8025.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides cooling only to the southeast classroom; 2,610 cfm at 3 hp	Fair condition
AHU-2	MZ	MZ AHU provides cooling only to the northwest classroom; 4,850 cfm at 5 hp	Fair condition
AHU-3	MZ	MZ AHU provides cooling only to the northeast administrative offices; 2,610 cfm at 3 hp	Fair condition
RAD-1	HW baseboard radiation	Perimeter radiation provides heating throughout the building	Fair condition
	Chilled Water	Chilled Water is provided by a Central Chiller Plant	
CWP-1	CW pump	1 hp pump serves MZ AHUs	Fair condition
	Steam	Steam is provided by a Central Boiler Plant	
CV-1	STM/HW Converter	CV-1 provides HW to RAD-1	Fair condition
HWP-1	HW pump	1-1/2 hp pump serves CV-1 and RAD-1	Fair condition

4.34.2 HVAC System Components for Repair

The HVAC system components for Building 8025 were observed to be in fair condition and are not in need of repair.

4.34.3 Proposed HVAC System Replacement

The three MZ AHUs serving Building 8025 were considered for conversion to VAV AHUs. The existing MZ AHUs will be modified as follows:

- VSD controllers will be installed on the MZ AHUs to control the supply fan speed.

- MZ AHUs have zone dampers for the hot decks and cold decks. The pneumatic actuators on the hot and cold deck zone dampers will be retrofitted with electric actuators and VAV terminal unit controllers. The retrofitted dampers will vary the airflow rate to each zone.
- Summer-Winter changeover switch will be installed to close the retrofitted dampers on the hot and cold decks during heating or cooling seasons. The hot deck damper will close during the cooling season, and the cold deck damper will close during the heating season.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7108 (Battalion Admin. and Classroom) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7108 is similar to Building 8025.

The analysis proceeded as follows:

- The computer model for Building 7108 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the MZ AHUs converted to VAV AHUs with VSDs. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	65
Annual Electric Demand Savings (\$)	(112)
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	\$679
Investment Cost	\$17,282
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$0
Savings-to-Investment Ratio (SIR)	0.63
Simple Payback (yrs)	25.45

4.34.4 Recommendations

The HVAC systems are not recommended for repair or replacement.



4.35 BUILDING 3 (POST CHAPEL)

4.35.1 HVAC System Existing Conditions

Building 3 is a 8,828 sq ft, one-story building with a conditioned basement. It was constructed in 1875 and has sandstone block foundations and walls. The Post Chapel has a sanctuary and sacristy on ground level with classrooms and a kitchen area in the basement. A H&V Unit and a cooling-only SZ AHU are connected to the same supply air ductwork, and provide heating and cooling to the entire building. A manual air damper can be set for either summer or winter operation. It is estimated that most of the HVAC equipment was installed during the early 1970s.

The following table describes the HVAC equipment serving Building 3.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides cooling to the entire building; SZ AHU is a packaged unit with a DX coil and compressor unit; 3/4 hp and approx. 4,800 cfm	Fair condition
H&V-1	H&V Unit	H&V Unit provides heating and ventilation air to the entire building; 3 hp and 5,000 cfm	Fair condition - very old
CT-1	Cooling Tower	Water cooling tower serves AHU-1	Poor condition - severe corrosion
BLR-1	STM Boiler	600,000 Btuh (output) Steam Boiler serves AHU-1 and H&V-1	Fair condition - very old

4.35.2 HVAC System Components for Repair

The AHU-1, H&V-1, BLR-1 system components were observed to be generally in fair condition. The CT-1 has severe corrosion, is beyond repair, and should be replaced.

4.35.3 Proposed HVAC System Replacement

All the HVAC equipment is recommended for replacement. AHU-1 and H&V-1 will be replaced with a VAV AHU serving three zones. The cooling tower and boiler will be replaced with more efficient equipment. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHU with VSD.

- Three VAV terminal units with reheat coils will be installed on existing ductwork. Three zones will be served by the VAV terminal units: west half of sanctuary and basement, east half of sanctuary and basement, and the sacristy at the north end of the building.
- HW boiler will be installed to provide hot water.
- Air cooled chiller will be installed to provide chilled water.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 6 (Post Chapel) was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 6 was used as the baseline computer model. It was modified to simulate the existing HVAC systems in Building 3.
- The baseline computer model was modified to include the HVAC replacement systems - the VAV AHU, the HW boiler, and the air cooled water chiller. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. Energy savings were prorated on a sq ft basis to Building 3.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	136
Annual Electric Demand Savings (\$)	131
Annual Natural Gas Savings (MBtu)	212
Total Annual Energy Cost Savings	\$2,653
Investment Cost	\$68,200
Annual Maintenance Cost Savings	\$724
Non-recurring Cost Savings	\$48,583
Savings-to-Investment Ratio (SIR)	1.42
Simple Payback (yrs)	11.75

4.35.4 Recommendations

The proposed HVAC system replacement is not recommended.



4.36 BUILDING 7086 (UNIT CHAPEL)

4.36.1 HVAC System Existing Conditions

Building 7086 is a 8,700 sq ft, one-story building. The building was built in 1957 and is constructed of face brick and concrete block. The building is divided into two functional areas, the church sanctuary and the administration offices. The administration offices are heated and cooled by FCs. The church sanctuary is heated and cooled by a large SZ AHU.

The following table describes the HVAC equipment serving Building 7086

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-11	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to the administration offices; a total of 11 FCs serve this area of building	Fair condition
AHU-1	SZ	SZ AHU provides heating and cooling to the church sanctuary; 5,400 cfm at 3 hp	Fair condition
ACCU-1	Air Cooled Condensing Unit	20 Ton ACCU serves SZ AHU with DX coil	Fair condition
CH-1-2	Reciprocating w/ Air Cooled Cond. - Split System	10 Ton chiller serves FCs	Fair condition
BLR-1	HW Boiler	907,000 BTUH (output) boiler serves FCs and SZ AHU	Fair condition
DTWP-1	Dual Temperature Water pump	1.5 hp pump serves BLR-1 and FCs	Fair condition
DTWP-2	Dual Temperature Water pump	3/4 hp pump serves BLR-1 and SZ AHU	Fair condition

4.36.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.36.3 Proposed HVAC System Replacement

The SZ AHU serving the church sanctuary in Building 7086 was considered for replacement with a VAV AHU. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHU with VSD.

- Two VAV terminal units with reheat coils will be installed on existing ductwork. The two zones served by the VAV terminal units are the north half and south half of the church sanctuary.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The EZDOE computer model for Building 7086 was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 7086 was used as the baseline computer model.

The baseline computer model was modified to include the HVAC replacement systems - the VAV AHU with VSD. The modified baseline is the ECO model. The following system parameters were also included:

- Supply air volume varies down to only 50%, to avoid DX coil freeze up.
- VAV terminal units vary supply air volume down to 20%.
- Supply fan utilizes a bypass when VAV terminal units vary supply air volume below 50%.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	92
Annual Electric Demand Savings (\$)	183
Annual Natural Gas Savings (MBtu)	122
Total Annual Energy Cost Savings	\$1,794
Investment Cost	\$19,280
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$12,554
Savings-to-Investment Ratio (SIR)	2.09
Simple Payback (yrs)	7.96

4.36.4 Recommendations

The proposed HVAC system replacement is recommended.



4.37 BUILDING 602 (DENTAL CLINIC)

4.37.1 HVAC System Existing Conditions

Building 602 is a 11,560 sq ft, one-story building. It was built in 1979 and is constructed of poured concrete foundations and walls. The dental clinic is heated and cooled by a dual duct (DD) AHU. Finned tube radiation units at the perimeter of the building provide additional heating.

The following table describes the HVAC equipment serving Building 602.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	Dual Duct	DD AHU with 42 mixing boxes provides heating and cooling to the entire building; 13,900 cfm at 25 hp	Fair condition
RAD-1	HW Finned tube radiation	Finned tube radiation units provide additional heating along the perimeter of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	78 Ton chiller serves the DD AHU	Fair condition
CWP-1	CW pump	2 hp pump serves CH-1 and DD AHU	Fair condition
BLR-1	Steam boiler	506,000 Btuh (output) steam boiler serves AHU-1 and RAD-1	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to AHU-1 and RAD-1	Fair condition
HWP-1	HW pump	1/4 hp pump serves AHU-1 and RAD-1	Fair condition

4.37.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition and are not in need of repair.

4.37.3 Proposed HVAC System Replacement

The DD AHU serving Building 602 was considered for conversion to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- DD AHU will be converted to a VAV DD AHU; a VSD will be installed.

- Existing ductwork will remain; the existing mixing boxes will be replaced with dual duct VAV terminal units.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7665 (Dental Clinic) was used to evaluate energy savings for the proposed HVAC system replacement in Building 602. The computer model building is similar in use and construction to Building 602.

The analysis proceeded as follows:

- The computer model for Building 7665 was modified to simulate the existing HVAC systems in Building 602. This computer model was used as the baseline.
- The baseline computer model was modified to include the proposed HVAC system replacement - the dual duct VAV AHU with VSD. The supply air volume varies down to 20%. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to derive the energy savings for Building 602.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	681
Annual Electric Demand Savings (\$)	1,242
Annual Natural Gas Savings (MBtu)	(132)
Total Annual Energy Cost Savings	\$8,934
Investment Cost	\$35,342
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$0
Savings-to-Investment Ratio (SIR)	3.94
Simple Payback (yrs)	3.96

4.37.4 Recommendations

The proposed HVAC system replacement is recommended.



4.38 BUILDING 7665 (DENTAL CLINIC)

4.38.1 HVAC System Existing Conditions

Building 7665 is a 11,080 sq ft, one-story building. It was built in 1965 and is constructed of face brick and concrete block. The dental clinic is heated and cooled by a six zone MZ AHU.

The following table describes the HVAC equipment serving Building 7665.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU (6 zones) provides heating and cooling to the entire building; 19,500 cfm at 15 hp	Fair condition
CH-1	Two Reciprocating Compressors	50 Ton chiller serves the MZ AHU	Fair condition
CT-1	Cooling Tower - Water	55 Ton Cooling Tower serves CH-1; 5 hp fan	Fair condition
CNWP-1	Condenser Water Pump	Condenser water pump serves CT-1; 5 hp pump	Fair condition
BLR-1	Steam boiler	650,000 Btuh (output) Steam boiler serves AHU-1	Fair condition

4.38.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition and are not in need of repair.

4.38.3 Proposed HVAC System Replacement

The MZ AHU serving Building 7665 was considered for conversion to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- VSD will be installed on the MZ AHU.
- Existing ductwork will remain; VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The EZDOE computer model for Building 7665 was used to evaluate energy savings for the proposed HVAC system replacement. The analysis proceeded as follows:

- The computer model for Building 7665 was used for the baseline computer model.
- The baseline computer model was modified to include the proposed HVAC system with a VSD. The modified baseline is the ECO model. The following system parameters were also included:
 - Supply air volume varies down to only 50%, to avoid DX coil freeze up.
 - Dual duct VAV terminal units vary supply air volume down to 20%.
 - Supply fan utilizes a bypass when VAV terminal units vary supply air volume below 50%.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life of the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	301
Annual Electric Demand Savings (\$)	637
Annual Natural Gas Savings (MBtu)	(107)
Total Annual Energy Cost Savings	\$3,834
Investment Cost	\$12,210
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$0
Savings-to-Investment Ratio (SIR)	4.85
Simple Payback (yrs)	3.18

4.38.4 Recommendations

The proposed HVAC system replacement is recommended.

4.39 BUILDING 7670 (DENTAL CLINIC)

4.39.1 HVAC System Existing Conditions

Building 7670 is a 14,960 sq ft, one-story building. It was built in 1976 and is constructed of face brick and concrete block walls. The dental clinic is heated and cooled by a DD AHU. Finned tube radiation units at the perimeter of the building provide additional heating.

The following table describes the HVAC equipment serving Building 7670.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	DD	DD AHU with 50 mixing boxes provides heating and cooling to the entire building; 25,400 cfm at 7.5 hp; 7.5 hp return air fan	Fair condition
RAD-1	HW Finned tube radiation	Finned tube radiation units provide additional heating along the perimeter of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	83 Ton chiller serves the DD AHU	Fair condition
CWP-1	CW pump	2 hp pump serves CH-1 and DD AHU	Fair condition
BLR-1	Steam boiler	782,000 Btuh (output) steam boiler serves AHU-1 and RAD-1	Good condition
CV-1	STM/HW Converter	STM/HW converter provides HW to AHU-1 and RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves AHU-1 and RAD-1	Fair condition

4.39.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.39.3 Proposed HVAC System Replacement

The DD AHU serving Building 7670 was considered for conversion to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- DD AHU will be converted to a VAV AHU; a VSD will be installed to control the supply and return fan speed.
- Existing ductwork will remain; the existing mixing boxes will be replaced with dual duct VAV terminal units.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7665 (Dental Clinic) was used to evaluate energy savings for the proposed HVAC system replacement in Building 7670. The computer model building is similar in use and construction to Building 7670.

The analysis proceeded as follows:

- The computer model for Building 7665 was modified to simulate the existing HVAC systems in Building 7670. This computer model was used as the baseline.
- The baseline computer model was modified to include the proposed HVAC system replacement - the dual duct VAV AHU with VSD. The supply air volume varies down to 20%. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to derive the energy savings for Building 7670.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	889
Annual Electric Demand Savings (\$)	958
Annual Natural Gas Savings (MBtu)	(173)
Total Annual Energy Cost Savings	\$11,006
Investment Cost	\$40,355
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$0
Savings-to-Investment Ratio (SIR)	4.26
Simple Payback (yrs)	3.67

4.39.4 Recommendations

The proposed HVAC system replacement is recommended.



4.40 BUILDING 7245 (ENLISTED PERSONNEL DINING)

4.40.1 HVAC System Existing Conditions

Building 7245 is a 14,000 sq ft, one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Three MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7245.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 5 hp	Poor condition - 2" cooling coil 3-way control valve is inoperable
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition - OA damper actuator linkage disconnected; inoperable
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition
MAU-3	MAU	MAU-3 provides heating and make-up air to the kitchen area; 1,000 cfm at 1 hp	Poor condition - OA damper actuator linkage disconnected; inoperable
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
	Chilled Water to the SZ AHUs	Chilled water is provided by a Central Chiller Plant	
CWP-1	CW pump	5 hp pump serves AHU-1 and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,900,000 Btuh output)	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.40.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1	SZ	2" CW control valve actuator inoperable - replace entire valve	426
MAU-1	MAU	OA damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223
MAU-3	MAU	OA damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223
Total Repair Cost			872

4.40.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving Building 7245 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added to, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer models for Building 7245 were used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer models, one for the dining area and one for the kitchen area in Building 7245 were used as the baseline computer models.
- The baseline computer models were modified to include the HVAC replacement systems - the VAV AHUs and the HRUs. The modified baselines are the ECO models. The ECO models included additional modifications as follows:
 - VAV controls vary the supply air volume down to 20%.
 - HRU heat recovery of exhaust air functions at 70% efficiency.
- The ECO models energy use was subtracted from the baselines energy use to find the energy savings for natural gas and electricity.
- Construction costs were developed for the proposed HVAC system replacements.
- The energy savings and the construction cost were entered into LCCA worksheets. Additional information entered into the LCCA worksheets included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings (\$)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	\$2,707
Investment Cost	\$33,387
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings (\$)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	\$16,047
Investment Cost	\$90,334
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.40.4 Evaluation of Dedicated Boilers for Service Water Heating

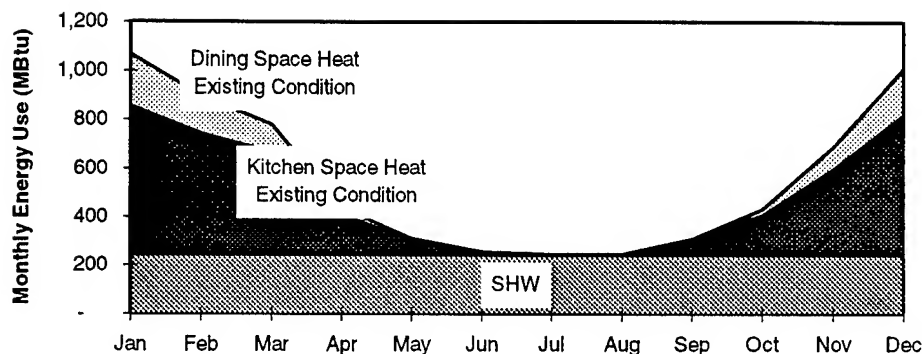
Proposed Modification

It is proposed to replace a steam boiler serving both space heating and service water heating (SWH) loads with separate dedicated boilers for each of the loads. The existing steam boiler serving combined loads operates at a low part load ratio. At low part load ratios, boilers have poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. These proposed modifications are applicable to any building which uses a single boiler for both space heating and SWH heating.

Analysis

Building 7245, an Enlisted Personnel Dining Facility, was selected for evaluation. This building has a single 6,900,000 Btuh output steam boiler which serves both space heating and HW heating loads. Analysis indicates that the actual peak demands are 1,772,000 Btuh and 1,645,000 Btuh for space heating and SWH heating, respectively. Monthly energy use profiles are indicated in the following figure.

Annual Load Profile

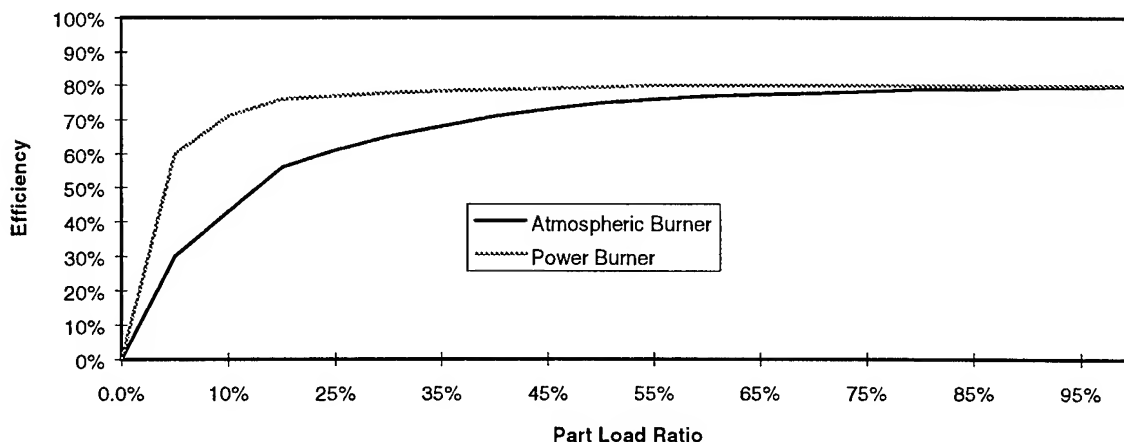


Monthly energy use varies from a maximum of about 1,100 MBtu to a minimum of about 250 MBtu.

It is proposed to provide a dedicated 2,000,000 Btuh steam boiler for SHW which would be used throughout the year and a second 2,000,000 Btuh HW boiler for space heating which would be used from October through April for space heating.

The amount of energy savings resulting from this strategy is highly dependent on the efficiency of the boiler at part load conditions. The following figure presents a range of boiler efficiency at varying part loads.

Boiler Efficiency Curves



The lower curve represents the efficiency of a boiler with an atmospheric burner. Boilers with atmospheric burners have no control on the amount of air moving through the boiler. Atmospheric burners cycle on and off in response to the load. During off periods, air

continues to flow through the boiler carrying heat from the hot water or steam in the boiler up the stack where it is lost to the atmosphere.

The higher curve represents the efficiency of a boiler with a power burner or a burner which controls air flow through the boiler. The power burner boiler has a much better efficiency curve.

Annual energy use calculations consisted of:

- Establishing an annual load profile
- Calculating part load ratios based on monthly loads and boiler capacity
- Looking up the boiler efficiency corresponding to the part load ratio
- Calculating monthly boiler energy use and summing for the annual energy use.

The existing steam boiler in Building 7245 is equipped with a power burner. The heat output of this boiler is nearly twice the peak heating demand on the boiler. The analysis indicates that the monthly part load ratio varies from 21% in January to less than 5% in the summer months.

The proposed SHW steam boiler would operate with a monthly part load ratio of 17%. The SHW load is highly variable, ranging from 1.5 gallons per meal for the peak use hours to a zero load at night. The proposed space heating HW boiler would operate with a monthly part load ratio ranging from 13% to 57% during the heating season, and be turned off during the summer season.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam and Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	\$4,957
Investment Cost	\$72,585
Annual Maintenance Cost Savings	(\$181)
Non-recurring Cost Savings	\$101,942
Savings-to-Investment Ratio (SIR)	2.47
Simple Payback (yrs)	7.35

4.40.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.



4.41 BUILDING 7606 (ENLISTED PERSONNEL DINING)

4.41.1 HVAC System Existing Conditions

Building 7606 is a 13,500 sq ft , one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Two MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7606.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 5 hp	Poor condition - 2" cooling coil 3-way control valve is inoperable
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition - 2" cooling coil 3-way control valve is inoperable
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves the SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1, AHU-1, and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,900,000 Btuh output)	Fair condition
CDP-1	Steam condensate pump	2 hp condensate pump - pumps condensate from heating equipment back to boiler	Fair condition - does not operate
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.41.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1	SZ	2" CW control valve actuator inoperable - replace entire valve	426
AHU-2	SZ	2" CW control valve actuator inoperable - replace entire valve	426
CDP-1	Steam condensate return pump	New steam condensate return pump does not operate; Replace motor	1,011
Total Repair Cost			1,863

4.41.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving building 7606 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer model for the proposed HVAC system replacements in Building 7245 was used to calculate energy savings for Building 7606. The proposed HVAC system replacements in Building 7606 are identical to Building 7245.

The analysis proceeded as follows:

- The energy savings for natural gas and electricity were taken from the HVAC systems replacement analysis in Building 7245.
- Construction costs was developed for the proposed HVAC system replacements.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings (\$)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	\$2,707
Investment Cost	\$33,387
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings (\$)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	\$16,047
Investment Cost	\$90,334
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.41.4 Evaluation of Dedicated Boilers for Space Heating and Service Water Heating

Proposed Modification

The steam boiler serving Building 7606 is used for both space heating and service water heating (SWH) loads. The steam boiler, serving the combined loads, operates at a low part load ratio. At the low part load ratio, the boiler has poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. Dedicated boilers were considered for replacement of the existing steam boiler.

Analysis

Building 7245, an Enlisted Personnel Dining Facility, was selected for evaluation (Section 4.40.4). This building has a 6,900,000 Btuh output steam boiler which serves both space heating and SWH heating loads. Building 7606 is identical to Building 7245. The energy savings for the proposed boiler replacement in Building 7606 were taken from the evaluation in Building 7245.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D calculations for Building 7245. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	\$4,957
Investment Cost	\$89,312
Annual Maintenance Cost Savings	(\$181)
Non-recurring Cost Savings	\$101,942
Savings-to-Investment Ratio (SIR)	2.01
Simple Payback (yrs)	9.05

4.41.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.



4.42 BUILDING 7654 (ENLISTED PERSONNEL DINING)

4.42.1 HVAC System Existing Conditions

Building 7654 is a 13,500 sq.ft., one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Two MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7654.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 5 hp	Poor condition - 2" cooling coil 3-way control valve is inoperable
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition - OA damper actuator linkage disconnected; inoperable
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition - Face & Bypass damper actuator linkage disconnected; inoperable
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	80 Ton chiller serves the SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1, AHU-1, and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,900,000 Btuh output)	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.42.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1	SZ	2" CW control valve actuator inoperable - replace entire valve	426
AHU-2	SZ	OA damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223
MAU-2	MAU	Face & Bypass damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223
Total Repair Cost			872

4.42.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving Building 7654 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer model for the proposed HVAC system replacements in Building 7245 was used to calculate energy savings for Building 7654. The proposed HVAC system replacements in Building 7654 are identical to Building 7245.

The analysis proceeded as follows:

- The energy savings for natural gas and electricity were taken from the proposed HVAC system replacements analysis in Building 7245.
- Construction costs were developed for the proposed HVAC system replacements.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings (\$)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	\$2,707
Investment Cost	\$33,387
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings (\$)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	\$16,047
Investment Cost	\$90,334
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.42.4 Evaluation of Dedicated Boilers for Space Heating and Service Water Heating

Proposed Modification

The steam boiler serving Building 7654 is used for both space heating and service water heating (SWH) loads. The steam boiler, serving the combined loads, operates at a low part load ratio. At the low part load ratio, the boiler has poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. Dedicated boilers were considered for replacement of the existing steam boiler.

Analysis

Building 7245, an Enlisted Personnel Dining Facility, was selected for evaluation (Section 4.40.4). This building has a 6,900,000 Btuh output steam boiler which serves both space heating and SWH heating loads. Building 7654 is identical to Building 7245. The energy savings for the proposed boiler replacement in Building 7654 were taken from the evaluation in Building 7245.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D calculations for Building 7245. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam and Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	\$4,957
Investment Cost	\$89,312
Annual Maintenance Cost Savings	(\$181)
Non-recurring Cost Savings	\$101,942
Savings-to-Investment Ratio (SIR)	2.01
Simple Payback (yrs)	9.05

4.42.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.



4.43 BUILDING 7804 (ENLISTED PERSONNEL DINING)

4.43.1 HVAC System Existing Conditions

Building 7804 is a 13,500 sq.ft., one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Two MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7804.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 5 hp	Poor condition
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition - Face & Bypass damper actuator linkage disconnected; inoperable
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	80 Ton chiller serves the SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1, AHU-1, and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,900,000 Btuh output)	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.43.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
MAU-2	MAU	Face & Bypass damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223

4.43.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving Building 7804 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added to, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer model for the proposed HVAC system replacements in Building 7245 was used to calculate energy savings for Building 7804. The proposed HVAC system replacements in Building 7804 are identical to Building 7245.

The analysis proceeded as follows:

- The energy savings for natural gas and electricity were taken from the proposed HVAC system replacements analysis in Building 7245.

- Construction costs were developed for the proposed HVAC system replacements.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings (\$)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	\$2,707
Investment Cost	\$33,387
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings (\$)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	\$16,047
Investment Cost	\$90,334
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.43.4 Evaluation of Dedicated Boilers for Space Heating and Service Water Heating

Proposed Modification

The steam boiler serving Building 7804 is used for both space heating and service water heating (SWH) loads. The steam boiler, serving the combined loads, operates at a low part load ratio. At the low part load ratio, the boiler has poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. Dedicated boilers were considered for replacement of the existing steam boiler.

Analysis

Building 7804, an Enlisted Personnel Dining Facility, was selected for evaluation (Section 4.40.4). This building has a 6,900,000 Btuh output steam boiler which serves both space heating and SWH heating loads. Building 7804 is identical to Building 7245. The energy savings for the proposed boiler replacement in Building 7804 were taken from the evaluation in Building 7245.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D calculations for Building 7245. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam and Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	\$4,957
Investment Cost	\$78,207
Annual Maintenance Cost Savings	(\$181)
Non-recurring Cost Savings	\$101,942
Savings-to-Investment Ratio (SIR)	2.29
Simple Payback (yrs)	7.92

4.43.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.

4.44 BUILDING 7856 (ENLISTED PERSONNEL DINING)

4.44.1 HVAC System Existing Conditions

Building 7856 is a 13,500 sq.ft., one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Two MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7856.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 3 hp	Poor condition - 3 hp supply fan motor bearings are noisy
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition - MAU has been disabled; motor is missing; large holes have been cut in OA duct and coil section to take in air from mezzanine area
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves the SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1, AHU-1, and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,500,000 Btuh output)	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves RAD-1	Fair condition

4.44.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the estimated cost for repair.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1	SZ	5 hp fan motor bearings are noisy; replace entire motor	276
MAU-2	MAU	1.5 hp fan motor is missing and requires installation; also OA ductwork and MAU coil casing requires patching	288
Total Repair Cost			564

4.44.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving Building 7856 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added to, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer model for the proposed HVAC system replacements in Building 7245 was used to calculate energy savings for Building 7856. The proposed HVAC system replacements in Building 7856 are identical to Building 7245.

The analysis proceeded as follows:

- The energy savings for natural gas and electricity were taken from the proposed HVAC system replacements analysis in Building 7245.
- Construction costs were developed for the proposed HVAC system replacements.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings (\$)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	\$2,707
Investment Cost	\$33,387
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings (\$)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	\$16,047
Investment Cost	\$90,334
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.44.4 Evaluation of Dedicated Boilers for Space Heating and Service Water Heating

Proposed Modification

The steam boiler serving Building 7856 is used for both space heating and service water heating (SWH) loads. The steam boiler, serving the combined loads, operates at a low part load ratio. At the low part load ratio, the boiler has poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. Dedicated boilers were considered for replacement of the existing steam boiler.

Analysis

Building 7245, an Enlisted Personnel Dining Facility, was selected for evaluation (Section 4.40.4). This building has a 6,900,000 Btuh output steam boiler which serves both space heating and SWH heating loads. Building 7856 is similar to Building 7245. The energy savings for the boiler replacement in Building 7856 were taken from the evaluation in Building 7245.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D calculations for Building 7245. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam and Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	\$4,957
Investment Cost	\$78,207
Annual Maintenance Cost Savings	(\$181)
Non-recurring Cost Savings	\$101,942
Savings-to-Investment Ratio (SIR)	2.29
Simple Payback (yrs)	7.92

4.44.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.



4.45 BUILDING 723 (MAINTENANCE HANGER COMB)

4.45.1 HVAC System Existing Conditions

Building 723 is a 21,640 sq.ft., two-story building. It was built during the mid-1950's and has a metal frame construction with walls consisting of insulated metal panels and concrete block. The building has administrative offices and shops on the first and second floors along the northwest and southeast walls. The maintenance bay is located in the center of the building between the administrative offices and shops. The administrative offices and shops are heated by finned tube radiation and are cooled by window AC units. The maintenance bay is heated by a HW radiant floor system. Floor mounted unit heaters, near the maintenance bay doors, provide heating for heating infiltration air when the doors are open.

The following table describes the HVAC equipment, serving Building 723.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1 thru UH-4	STM Floor-Mounted Unit Heaters (Industrial type)	UH-1 through UH-4 serve the maintenance bay; provides heating for infiltration loads from bay door openings	Fair condition
CDP-1 thru CDP-4	Steam condensate pump	1/3 hp condensate pumps - pump condensate from UHs and finned tube radiation units back to steam boiler	Poor condition - all are leaking; each pump is running continuously
RAD-1	HW Tube Floor Radiation	HW tube system in the concrete floor provides radiant heating for the maintenance bay area	Fair condition
RAD-2	STM Finned Tube Radiation	STM finned tube radiation units provide heating in the administration offices and shop areas	Fair condition
BLR-1	Steam Boiler	2,603,000 BTUH (output) Boiler serves UHs, RAD-1, and RAD-2	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition
WAC-1 Thru WAC-4	Window Air-Conditioners	4 WACs provide cooling for the administrative offices and shops (1st & 2nd floors)	Fair condition

4.45.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
CDP-1 thru CDP-4	Steam condensate pump	Replace seals on condensate receivers and pumps; Repair pumps shut-off controls	1,439

4.45.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 723 were not considered for HVAC system replacement.

4.45.4 Recommendations

The HVAC system components for repair are recommended.

4.46 BUILDING 727 (MAINTENANCE HANGER COMB)

4.46.1 HVAC System Existing Conditions

Building 727 is a 36,170 sq.ft., two-story building. The original building was built during the mid-1950's and has a metal frame construction with walls consisting of insulated metal panels and concrete block. An addition was built in 1980 to accommodate administrative offices and shops. These offices and shops are located on ground level along the full length of the northwest and southeast walls. The maintenance bay (original building) is located in the center of the building between the administrative offices and shops.

The administrative offices are heated and cooled by a SZ AHU. The shops assembly area, testing area, and breakroom are heated and cooled by a MZ AHU. The remainder of the shops areas are heated by UHs. The maintenance bay is heated by a HW radiant floor system. Floor-mounted unit heaters, near the maintenance bay doors, provide heating for infiltration air when the doors are open.

The following table describes the HVAC equipment, serving Building 727.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the administration offices on the northwest side of the building	Fair condition
AHU-2	MZ	MZ AHU provides heating and cooling to the shops assembly area, testing area, and breakroom on the southeast side of the building	Fair condition - OA/RA damper actuator is inoperable; damper linkage is wired so RA is open and OA is closed
ACCU-1	Air Cooled Condensing Unit	25 Ton ACCU serves the MZ AHU with DX coil	Fair condition
ACCU-2	Air Cooled Condensing Unit	12 Ton ACCU serves the SZ AHU with DX coil	Fair condition
UH-1 thru UH-4	STM Floor-Mounted Unit Heaters (Industrial type)	UH-1 through UH-4 serve the maintenance bay; provides heating for infiltration loads from bay door openings	Fair condition
CDP-1 thru CDP-4	Steam condensate pump	1/3 hp condensate pumps - pump condensate from UHs and finned tube radiation units back to steam boiler	Poor condition - all are leaking; one motor missing; one with noisy bearings
CV-1	Steam/HW converter	Steam/HW converter serves RAD-1	Fair condition
RAD-1	HW Tube Floor Radiation	HW tube system in the concrete floor provides radiant heating for the maintenance bay area	Fair condition
HWP-1 and HWP-2	HW pump	1-1/2 hp pumps serve RAD-1; one pump is standby	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-2	STM Finned Tube Radiation	STM finned tube radiation units provide heating in the latrines (northwest addition)	Fair condition
BLR-1	Steam Boiler	3,350,000 BTUH (output) STM Boiler serves SZ AHU, UHs, CV-1, and RAD-2	Fair condition
UH-1 thru UH-3	STM Unit Heaters	UH-1 thru UH-3 provide heat to storage area and battery room (northwest addition)	Fair condition
BLR-2	HW Boiler	360,000 BTUH (output) HW Boiler serves MZ AHU, UHs, and finned tube radiation in the southeast addition	Fair condition
UH-1 thru UH-9	HW Unit Heaters	UH-1 thru UH-9 provide heat to the shops and paint booth (southeast addition)	Fair condition
RAD-3	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the latrines and storage area (southeast addition)	Fair condition
HWP-1	HW pump	3 hp pump serves MZ AHU, UHs, and RAD-3	Fair condition

4.46.2 HVAC System Components for Repair

The HVAC system components were observed to be poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-2	MZ	Replace OA/RA pneumatic damper actuator; repair linkage	222
CDP-1 thru CDP-4	Steam condensate pump	Replace seals on condensate receivers and pumps; Repair pumps shut-off controls	1,440
CDP-2	Steam condensate pump	Replace 1/3 hp pump motor	273
Total Repair Cost			1,935

4.46.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 727 were not considered for HVAC system replacement.

4.46.4 Recommendations

The HVAC system components for repair are recommended.



4.47 BUILDING 741 (MAINTENANCE HANGER COMB)

4.47.1 HVAC System Existing Conditions

Building 741 is a 38,900 sq.ft., two-story building. It was built during the mid-1950's and has a metal frame construction with concrete block walls. The building has administrative offices and shops on the first floor east and west walls. The center area of the building has first floor supply rooms and toilets, and second floor administration offices. Two maintenance bays are located on either side of the center area rooms.

The administrative offices and shops are heated by steam finned tube radiation and are cooled by window AC units. The maintenance bays are heated by four floor mounted fan coil units.

The following table describes the HVAC equipment, serving Building 741.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1 thru UH-4	Steam Floor-Mounted Unit Heaters (Industrial type)	UH-1 through UH-4 provide heating for the maintenance bays; fans are 5 hp at 14,200 cfm each; heating coils are 980,000 Btuh each	Poor condition -heating coils are leaky
UH-5 thru UH-8	Steam Unit Heaters	UH-5 through UH-8 provide heating for the administration offices and shop areas	Fair condition
RAD-1	Steam Finned Tube Radiation	Steam finned tube radiation units provide heating in the administration offices and shop areas	Fair condition
BLR-1	Steam Boiler	5,657,000 Btuh (output) Boiler serves UHs and RAD-1; steam condensate is gravity return	Fair condition
WAC-1 Thru WAC-8	Window Air-Conditioners	8 WACs provide cooling for the administrative offices and shops (1st & 2nd floors)	Fair condition

4.47.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition, except for the heating coils in UH-1 through UH-4. The HVAC system components in need of immediate repair are listed in the following table with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
UH-1 thru UH4	Steam floor - mounted unit heaters (industrial type)	Replace 4 steam heating coils, 980,000 Btuh each	4,975

4.47.3 Proposed HVAC System Replacement

The unit heaters and finned tube radiation units serving Building 741 were considered for replacement. UH-1 through UH-4 will be replaced with a gas-fired IR tube heating system. UH-5 through UH-8 and the finned tube radiation units will be replaced with a gas-fired residential furnaces.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model analysis for Building 7176 (Vehicle Maintenance Shop) was used to evaluate energy savings for the proposed HVAC system replacement in Building 741. The computer model building is similar in use to Building 741.

The analysis proceeded as follows:

- The baseline computer model for Building 7176 was used.
- The ECO model for Building 7176 was used.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to Building 741.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacements are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	213
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	626
Total Annual Energy Cost Savings	\$5,161
Investment Cost	\$142,228
Annual Maintenance Cost Savings	\$600
Non-recurring Cost Savings	\$63,690
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.90

4.47.4 Recommendations

The HVAC systems are not recommended for repair or replacement.



4.48 BUILDING 820 (TACTICAL EQUIPMENT SHOP)

4.48.1 HVAC System Existing Conditions

Building 820 is a 20,560 sq.ft., two-story building. It was built in 1984 and has a metal frame construction with insulated metal panel walls. Equipment supply rooms (on the first floor), and administrative offices and classrooms (on the second floor) are located at the center of the building. Two maintenance bays are located on either side of the center area of the building.

The second floor administrative offices and classrooms are heated by a combination of HW finned tube radiation and a SZ AHU. They are cooled by the SZ AHU. The first floor equipment supply rooms are heated by a combination of HW finned tube radiation and a H&V Unit. The maintenance bays are heated by UHs (four UHs per bay) and have one MAU per bay for heating makeup air for exhaust fans and infiltration air when the doors are open.

The following table describes the HVAC equipment, serving Building 820.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the second floor offices and classrooms (5 hp fan motor; 4,800 cfm)	Fair condition
H&V-1	H&V Unit	H&V Unit provides heating to the first floor equipment supply rooms (3 hp fan motor; 3,400 cfm)	Fair condition
MAU-1	MAU	MAU-1 provides heated makeup air for exhaust fans and additional heating of infiltration air when doors are open (3 hp fan motor; 3,100 cfm)	Fair condition - pneumatic line to 1-1/2" HW 3-way control valve is disconnected
MAU-2	MAU	MAU-2 provides heated makeup air for exhaust fans and additional heating of infiltration air when doors are open (3 hp fan motor; 3,100 cfm)	Fair condition
UH-1 thru UH-8	HW Unit Heaters	UH-1 through UH-8 serve the maintenance bays; four UHs per bay	Fair condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the first and second floor offices, classrooms, and supply rooms	Fair condition
BLR-1	Steam Boiler	2,318,000 BTUH (output) Boiler serves AHU-1, H&V-1, MAUs UHs, and RAD-1	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
HWP-1	HW pump	10 hp pump serves AHU-1, H&V-1, MAUs, UHs, and RAD-1	Poor condition - very noisy; Replace pump motor, seals, and bearings
CH-1	Reciprocating w/ Air Cooled Cond.	10 Ton chiller serves the SZ AHU	Fair condition

4.48.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
MAU-1	MAU	Repair 1-1/2" HW control valve and reconnect pneumatic line	599
HWP-1	HW pump	Replace 10 hp HW pump motor; replace pump seals and bearings	1,495
Total Repair Cost			2,094

4.48.3 Proposed HVAC System Replacement

The HW unit heaters serving the maintenance bays in building 820 were considered for replacement with a gas-fired IR tube heating system. A HW boiler will continue to serve AHU-1, H&V-1, MAU-1, MAU-2, and RAD-1. The HW boiler and HW pump will be replaced with smaller, energy efficient models.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8300 (Vehicle Maintenance Shop) was used to evaluate energy savings for the proposed HVAC system replacement in Building 820. The computer model building is similar in use and construction to Building 820. The analysis proceeded as follows:

- The computer model zone for the Building 8300 maintenance bay was modified to include the existing heating system types found in Building 820. These modifications represent the baseline computer model for Building 820.
- The baseline computer model was modified to include the HVAC replacement system - the gas-fired IR heating system. The modified baseline is the ECO model. The ECO model included additional modifications as follows:

- Thermostat settings were lowered by 4°F. IR heating systems heat in a manner similar to sunlight, which allows an occupant comfort condition at a reduced air temperature.
- Combustion efficiency for heating equipment was adjusted to 90%.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a sq ft basis to Building 820.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated based on estimated labor hours and materials.
 - Non-recurring costs included the fifth year replacement of the existing HW unit heaters and HW boiler.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the IR heating system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	11
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	104
Total Annual Energy Cost Savings	\$560
Investment Cost	\$37,546
Annual Maintenance Cost Savings	\$370
Non-recurring Cost Savings	\$43,700
Savings-to-Investment Ratio (SIR)	1.42
Simple Payback (yrs)	12.05

4.48.4 Recommendations

The HVAC system components for repair is recommended.



4.49 BUILDING 1470 (AR VEHICLE MAINTENANCE SHOP)

4.49.1 HVAC System Existing Conditions

Building 1470 is a 21,670 sq.ft., two-story building. The original building was built during the mid-1970s. An addition to the building was built in 1989. Both the original building and the addition have a metal frame construction with insulated metal panel walls. The original building has an office area, supply room and a warehouse. The addition has an office area and a large maintenance bay.

The original building offices and supply room are heated and cooled by a SZ AHU. The original building warehouse is heated by HW UHs. The addition offices are heated and cooled by a SZ AHU. HW finned tube radiation units provide additional heating to the original building and addition offices and supply room. The maintenance bay are heated by HW UHs. The maintenance bay also has a MAU to provide heated makeup air when exhaust fans are operating.

The following table describes the HVAC equipment, serving Building 1470.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the original building offices (1/3 hp fan motor; 2,500 cfm)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling to the addition offices (1/3 hp fan motor; 2,000 cfm)	Good condition
MAU-1	MAU	MAU-1 provides heated makeup air for exhaust fans (20 hp fan motor; 22,200 cfm; gas-fired)	Fair condition
UH-1 thru UH-10	HW Unit Heaters	UH-1 through UH-10 serve the maintenance bay	Fair condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide additional heating throughout the original building and addition offices and supply room	Fair condition
BLR-1	HW Boiler	792,000 BTUH (output) Boiler serves AHU-2, UHs, and RAD-1	Fair condition
BLR-2	HW Boiler	792,000 BTUH (output) Boiler (standby)	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1, BLR-2, AHU-2, UHs, and RAD-1	Fair condition
HWP-2	HW pump	2 hp pump (standby)	Fair condition
ACCU-1	Air Cooled Condensing Unit	5 Ton ACCU serves AHU-1	Good condition
ACCU-2	Air Cooled Condensing Unit	5 Ton ACCU serves AHU-2	Fair condition

4.49.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system components are not in need of repair.

4.49.3 Proposed HVAC System Replacement

The HVAC systems serving Building 1470 were not considered for replacement. A proposed HVAC system replacement for Building 820, similar to Building 1470, was considered. The system replacement in Building 820 was not economically feasible, and therefore would not be economically feasible in Building 1470.

4.49.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.50 BUILDING 7176 (VEHICLE MAINTENANCE SHOP)

4.50.1 HVAC System Existing Conditions

Building 7176 is a 4,880 sq.ft., one-story building. The building was built in 1956 and is constructed of concrete block. The building has a small office area and a large maintenance bay.

The office area and maintenance bay are heated by HW UHs. A small storage area and the latrine are heated by HW finned tube radiation.

The following table describes the HVAC equipment, serving Building 7176.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1 thru UH-5	STM Unit Heaters	UH-1 through UH-5 serve the office area and maintenance bay	Fair condition
RAD-1	STM Finned Tube Radiation	Steam finned tube radiation units provide heating in the storage room and latrine	Fair condition
BLR-1	Steam Boiler	1,000,000 BTUH (output) steam boiler serves UHs and RAD-1	Fair condition

4.50.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system components are not in need of repair.

4.50.3 Proposed HVAC System Replacement

The unit heaters, finned tube radiation units, and steam boiler serving Building 7176 were considered to be replaced with a gas-fired IR heating system. The unit heaters will be replaced with a gas-fired IR tube system and the finned tube radiation units will be replaced with gas-fired IR heaters. The steam boiler will be removed.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8300 (Vehicle Maintenance Shop) was used to evaluate energy savings for the proposed HVAC system

replacement in Building 7176. The computer model building is similar in use and construction to Building 7176. The analysis proceeded as follows:

- The computer model zone for the Building 8300 maintenance bay was modified to include the existing heating system types found in Building 7176. These modifications represent the baseline computer model for Building 7176.
- The baseline computer model was modified to include the HVAC replacement system - the gas-fired IR heating system. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
 - Thermostat settings were lowered by 4°F. IR heating systems heat in a manner similar to sunlight, which allows an occupant comfort condition at a reduced air temperature.
 - Combustion efficiency for heating equipment was adjusted to 90%.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Annual maintenance costs were calculated using estimated labor hours and materials.
 - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the IR heating system replacements are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	28
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	83
Total Annual Energy Cost Savings	\$688
Investment Cost	\$27,000
Annual Maintenance Cost Savings	\$600
Non-recurring Cost Savings	\$24,734
Savings-to-Investment Ratio (SIR)	1.56
Simple Payback (yrs)	10.70

4.50.4 Recommendations

The proposed HVAC system replacement is not recommended.



4.51 BUILDING 7920 (DS VEHICLE MAINTENANCE SHOP)

4.51.1 HVAC System Existing Conditions

Building 7920 is a 124,550 sq.ft., two-story building. The building was built in 1971 and is constructed of concrete block. The layout of the building is like a five-point star, with five maintenance wings connected at the center (the center area being a large equipment supply room). Each wing has a maintenance bay, office area, storage area, and latrines. Two of the maintenance wings are used for general purpose maintenance and have HVAC equipment that are alike. Three of the maintenance wings are Company maintenance wings and have HVAC equipment that are alike.

The following table describes the HVAC equipment, serving Building 7920.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1, AHU-2 and AHU-3	SZ	SZ AHUs provide heating and cooling to the general maintenance wings offices; each has a gas-fired furnace (1-1/2 hp fan motor; 3,700 cfm each)	Fair condition
ACCU-1, ACCU-2, and ACCU-3	Air Cooled Cond.	8 Ton ACCUs serve AHU-1 thru AHU-3	Fair condition
H&V-1 and H&V-2	H&V	H&Vs provide heating to the general maintenance wings storage areas and latrines; each has a gas-fired furnace (3 hp fan motor; 5,000 cfm each)	Fair condition
MAU-1 and MAU-2	MAU	MAUs provide heating of makeup air for the general maintenance wings bays; each has a gas-fired furnace (10 hp fan motor; 20,250 cfm each)	Fair condition
RAD-1 thru RAD-42	Infrared Radiant Heater (gas-fired)	IR heaters serve the general maintenance wing bays.	Fair condition
AHU-4, AHU-5, and AHU-6	SZ	SZ AHUs provide heating and cooling to the Company maintenance wings offices; each has a gas-fired furnace (1-1/2 hp fan motor; 3,700 cfm each)	Fair condition
ACCU-4, ACCU-5, and ACCU-6	Air Cooled Cond.	8 Ton ACCUs serve AHU-4 thru AHU-6	Fair condition
H&V-3, H&V-4, and H&V-5	H&V	H&Vs provide heating to the Company maintenance wings storage areas and latrines; each has a gas-fired furnace (3 hp fan motor; 5,000 cfm each)	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
MAU-3, MAU-4, and MAU-5	MAU	MAUs provide heating of makeup air for the Company maintenance wings bays; each has a gas-fired furnace (10 hp fan motor; 20,250 cfm each)	Fair condition
RAD-43 thru RAD-109	Infrared Radiant Heater (gas-fired)	IR heaters serve the Company maintenance wing bays.	Fair condition
UH-1 thru UH-11	Gas-fired Unit Heaters	UH-1 through UH-11 provide heating for the center area equipment supply room	Fair condition
DH-1 thru DH-8	Gas-fired Door Heaters	DH-1 through DH-8 provide heating for the infiltration air when overhead doors are opened	Fair condition

4.51.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system components are not in need of repair.

4.51.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 7920 were not considered for replacement.

4.51.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.52 BUILDING 8390 (TACTICAL EQUIPMENT SHOP)

4.52.1 HVAC System Existing Conditions

Building 8390 is a 24,755 sq.ft., two-story building. It was built in 1984 and has a metal frame construction with insulated metal panel walls. Offices, repair shops, and equipment supply rooms (on the first floor), and administrative offices and classrooms (on the second floor) are located at the center of the building. Two maintenance bays are located on either side of the center area of the building. The second floor administrative offices and classrooms are heated by a combination of HW finned tube radiation and a SZ AHU. They are cooled by the SZ AHU. The first floor offices, shops, and supply rooms are heated by a combination of HW finned tube radiation and a H&V Unit. The maintenance bays are heated by UHs (four UHs per bay) and have one MAU per bay for heating makeup air for exhaust fans and infiltration air when the doors are open.

The following table describes the HVAC equipment, serving Building 8390.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the second floor offices and classrooms (3 hp fan motor; 3,475 cfm)	Fair condition - OA/RA damper actuator missing
H&V-1	H&V Unit	H&V Unit provides heating to the first floor offices, shops, and supply rooms (3 hp fan motor; 3,345 cfm)	Fair condition
MAU-1	MAU	MAU-1 provides heated makeup air for exhaust fans and additional heating of infiltration air when doors are open in north maintenance bay (2 hp fan motor; 4,700 cfm)	Fair condition - 1" pneumatic 3-way control valve leaking
MAU-2	MAU	MAU-2 provides heated makeup air for exhaust fans and additional heating of infiltration air when doors are open in south maintenance bay (2 hp fan motor; 4,700 cfm)	Fair condition - 1" pneumatic 3-way control valve is leaking
UH-1 thru UH-8	HW Unit Heaters	UH-1 through UH-8 serve the maintenance bays; four UHs per bay	Fair condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the first and second floor offices, classrooms, shops, and supply rooms	Fair condition - zone control valves are leaky (approx. 8 control valves)
BLR-1	Steam Boiler	2,600,000 BTUH (output) Boiler serves AHU-1, H&V-1, MAUs, UHs, and RAD-1	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
HWP-1	HW pump	15 hp pump serves AHU-1, H&V-1, MAUs, UHs, and RAD-1	Fair condition
ACCU-1	Air Cooled Cond.	8 Ton chiller serves the SZ AHU	Fair condition

4.52.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-2	SZ	Replace OA/RA pneumatic damper actuator; repair linkage	223
MAU-1	MAU	Replace 1" pneumatic 3-way control valve	206
MAU-2	MAU	Replace 1" pneumatic 3-way control valve	206
RAD-1	HW Finned Tube Radiation	Replace 8 - 3/4" pneumatic 3-way control valves	1,340
Total Repair Cost			1,975

4.52.3 Proposed HVAC System Replacement

A proposed HVAC system replacement, similar to Building 820, was considered. The system replacement in Building 820 was not economically feasible, and therefore would not be economically feasible in Building 8390.

4.52.4 Recommendations

The HVAC system components for repair are recommended.

4.53 BUILDING 202 (PHYSICAL FITNESS CENTER)

4.53.1 HVAC System Existing Conditions

Building 202 is a 51,300 sq.ft., two-story building. It was constructed during the early 1900's and has sandstone block foundations and walls. The building was originally used as an indoor riding arena for horses. In 1948, the building was completely renovated to establish a physical fitness center.

The Physical Fitness Center has a basketball gymnasium at the center of the building, including an office and storage area. The south end of the building has four raquetball courts, with a men's locker room on the first floor, and an office area and exercise room on the second floor. The north end of the building has a weight training room, women's locker room, and a storage area on the first floor; the entire second floor is a roller skating rink.

The basketball gymnasium is heated by two large industrial UHs (one located at either end of the gymnasium). The raquetball courts are heated by a floor-mounted UH (located in a nearby storage room) and an exhaust fan in the attic. The men's locker room, and the second floor office area and exercise room, are heated and ventilated by a H&V Unit (located in the attic.) A floor-mounted industrial type UH provides heat to the weight training room and the women's locker room. A small packaged AHU provides cooling for the weight training room. The roller skating rink is heated and cooled by a SZ AHU located in the attic space above the rink.

The following table describes the HVAC equipment serving Building 202.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1 and UH-2	Wall-mounted UH (industrial type)	UHs provide heating to the basketball gymnasium; approx. 8,000 cfm at 3 hp each	Fair condition - very old
UH-3	Floor-mounted UH (industrial type)	UH provides heating to the raquetball courts; approx. 8,000 cfm at 3 hp; exhaust fan removes excess heat in summer; 6,500 cfm at 3 hp	Fair condition
H&V-1	H&V	H&V serves the men's locker room and second floor office and exercise room area; 8,000 cfm at 3 hp	Fair condition - very old
UH-4	Floor-mounted UH (industrial type)	UH provides heating to the weight training room and women's locker room; 8,000 cfm at 3 hp	Fair condition - very old
AHU-1	packaged SZ	SZ AHU provides cooling to the weight training room; 3,000 cfm at 1.5 hp	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-2	SZ	SZ AHU provides heating and cooling to the roller skating rink; 12,500 cfm at 5 hp	Good condition
CT-1	Water Cooling Tower	CT-1 serves AHU-1	Fair condition - some water scale build-up on interior
ACCU-1	Air Cooled Condensing Unit	45 Ton ACCU serves AHU-2 DX coil	Fair condition - condenser coil fins are damaged
WAC-1 Thru WAC-9	Window Air-Conditioners	9 WACs provide cooling for the offices (1st and 2nd floors)	Fair condition
BLR-1	Steam boiler	Steam boiler (4,250,000 Btuh output) serves the UHs, H&V, and AHU-2	Fair condition

4.53.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
ACCU-1	Air Cooled Condensing Unit	Air cooled condenser coil fins have been damaged by vandalism; replace condenser coil and provide protective screen for cover	979

4.53.3 Proposed HVAC System Replacement

UH-1 and UH-2, serving the basketball gymnasium, were considered for replacement with H&V Units. These UHs were installed in 1948, which makes them approximately 47 years old, and are still in fair condition. The following HVAC equipment, materials, and labor will be included in the system replacement:

- Two wall-mounted UHs will be replaced with four ceiling-hung H&V Units.
- OA ductwork will be installed and connected to each H&V Unit.
- Steam will be piped to each H&V Unit from existing steam main piping.
- Electric thermostats will be installed for each H&V Unit.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8069 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8069 is similar to Building 202. The analysis proceeded as follows:

- The computer model for Building 8069 was used as the baseline computer model for Building 202. The baseline model included the following parameters for the H&V Units:
 - Fan efficiency is 65%;
 - Heating thermostat setpoint is 75 F to simulate a condition of poor space temperature control.
- The baseline computer model was modified to include the proposed HVAC system replacement - H&V Units. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
 - Fan efficiency is 75%;
 - Heating thermostat setpoint is 70 F to simulate a condition of effective space temperature control.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. Energy savings were prorated on a sq ft basis to Building 202.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	20
Annual Electric Demand Savings (\$)	48
Annual Natural Gas Savings (MBtu)	148
Total Annual Energy Cost Savings	\$894
Investment Cost	\$64,001
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$17,611
Savings-to-Investment Ratio (SIR)	0.48
Simple Payback (yrs)	36.08

4.53.4 Recommendations

The HVAC system component for repair is recommended.

4.54 BUILDING 7485 (BOWLING ALLEY)

4.54.1 HVAC System Existing Conditions

Building 7485 is a 36,970 sq ft, one-story building. The original building (22 bowling lanes) was built in 1966 and an addition (18 bowling lanes) was added in 1987. Both are constructed of face brick and concrete block.

The original building is heated and cooled by a DD AHU. The addition is heated and cooled by a VAV terminal reheat system.

The following table describes the HVAC equipment serving Building 7485.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	Dual Duct	DD AHU with 19 mixing boxes provides heating and cooling to the approx. 55% of the building (20 hp and 16,000 cfm)	Fair condition
AHU-2	VAV Reheat	VAV Reheat AHU with 12 VAV boxes provides heating and cooling to approx. 45% of the building (10 hp and 10,000 cfm)	Fair condition - VSD controller does not operate
UH-1 and UH-2	HW Unit Heater	UHs provide heating for storage/maintenance area in addition	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	60 Ton chiller serves the DD AHU	Fair condition
CH-2	Reciprocating w/ Air Cooled Cond.	28 Ton chiller serves the VAV Reheat AHU	Fair condition
BLR-1	HW Boiler	1,600,000 Btuh (output) HW boiler serves AHU-1 and AHU-2	Fair condition
HWP-1	HW pump	3 hp pump serves AHU-1, AHU-2, and UHs	Fair condition

4.54.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-2	VAV Reheat	Replace the existing VSD controller with a new 10 hp VSD controller	3,459

4.54.3 Proposed HVAC System Replacement

The DD AHU serving Building 7485 was considered for conversion to be upgraded to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- DD AHU will be converted to a DD VAV AHU; a VSD will be installed.
- Existing ductwork will remain; the existing mixing boxes will be replaced with dual duct VAV terminal units.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The EZDOE computer model for Building 7485 was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 7485 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the dual duct VAV AHU with VSD. The modified baseline is the ECO model. The following system parameters were also included:
 - Supply air volume varies down to only 50%, to avoid DX coil freeze up.
 - Dual duct VAV terminal units vary supply air volume down to 20%.
 - Supply fan utilizes a bypass when VAV terminal units vary supply air volume below 50%.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
 - The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	488
Annual Electric Demand Savings (\$)	850
Annual Natural Gas Savings (MBtu)	(293)
Total Annual Energy Cost Savings	\$5,552
Investment Cost	\$15,055
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$0
Savings-to-Investment Ratio (SIR)	5.61
Simple Payback (yrs)	2.71

4.54.4 Recommendations

The HVAC system component for repair and the proposed HVAC system replacement are recommended.



4.55 BUILDING 6914 (MAIN EXCHANGE)

4.55.1 HVAC System Existing Conditions

Building 6914 is a 63,930 sq ft, one-story building. The building was built in 1973 and is constructed of face brick and concrete block. The Main Exchange has a main retail center, administration offices, and a warehouse. Several small services shops are located along the front of the building.

The retail center is heated and cooled by a SZ AHU. The administration office area adjacent to the retail center is heated and cooled by a SZ AHU. The warehouse is heated by a H&V Unit. The south and north services shops are heated and cooled by two MZ AHUs.

The following table describes the HVAC equipment serving Building 6914.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the main retail center (20 hp and 28,100 cfm)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling to the admin. offices in the main retail center (2 hp and 3,500 cfm)	Fair condition - pneumatic control valve for cooling coil is disconnected from air supply
AHU-3	H&V	H&V Unit provides heating to the warehouse in the main retail center (5 hp and 7,390 cfm)	Fair condition
AHU-4	MZ	MZ AHU provides heating and cooling to the south services shops (10 hp and 9,620 cfm)	Fair condition - pneumatic control valves for cooling coil, heating coil, and OA/RA dampers are disconnected from air supply
AHU-5	MZ	MZ AHU provides heating and cooling to the north services shops (7-1/2 hp and 6,790 cfm)	Fair condition - pneumatic control valves for cooling coil, heating coil, and OA/RA dampers are disconnected from air supply
CH-1	Reciprocating	127 ton chiller serves AHU-1, AHU-2, AHU-4, and AHU-5	Fair condition
ACCU-1 and ACCU-2	Air Cooled Condensing Unit	90 tons (each) ACCUs serve CH-1	Fair condition
CH-2	Reciprocating	127 ton chiller serves AHU-1, AHU-2, AHU-4, and AHU-5	Fair condition
ACCU-3 and ACCU-4	Air Cooled Condensing Unit	90 tons (each) ACCUs serve CH-2	Fair condition
CWP-1 and CWP-2	CW pump	7.5 hp (each) pump serves CH-1, CH-2, AHU-1, AHU-2, AHU-4, and AHU-5	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
BLR-1	HW Boiler	1,600,000 Btuh (output) HW boiler serves AHU-1 and AHU-2	Fair condition
HWP-1 and HWP-2	HW pump	5 hp (each) pump serves AHU-1, AHU-2, AHU-3, AHU-4, and AHU-5	Fair condition

4.55.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-2	SZ	Replace 1-1/2" pneumatic control valve for cooling coil	300
AHU-4	MZ	Replace pneumatic control valves for cooling coil (2") and heating coil (1-1/4"); replace pneumatic actuator on OA/RA dampers	899
AHU-5	MZ	Replace pneumatic control valves for cooling coil (2") and heating coil (1-1/4"); replace pneumatic actuator on OA/RA dampers	899
Total Repair Cost			2,098

4.55.3 Proposed HVAC System Replacement

The MZ AHUs serving the service shops in Building 6914 were considered for conversion to VAV AHUs. The following equipment and materials will be included in the proposed HVAC system replacement:

- VSDs will be installed on the MZ AHUs.
- Existing ductwork will remain; VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7108 (Battalion Admin. and Classroom) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7108 is similar to this area of Building 6914, in construction and use. Both buildings have similar HVAC systems.

The analysis proceeded as follows:

- The computer model for Building 7108 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the VAV AHUs with VSDs. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to Building 6914.
- A construction cost was developed for the proposed HVAC system replacement.
 - The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	145
Annual Electric Demand Savings (\$)	(18)
Annual Natural Gas Savings (MBtu)	(4)
Total Annual Energy Cost Savings	\$1,722
Investment Cost	\$29,431
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$0
Savings-to-Investment Ratio (SIR)	0.93
Simple Payback (yrs)	17.09

4.55.4 Recommendations

The HVAC system components for repair is recommended.



4.56 BUILDING 6940 (INDOOR SWIMMING POOL)

4.56.1 HVAC System Existing Conditions

Building 6940 is a 23,450 sq ft, one-story building. The building was built in 1976 and has metal frame construction with walls consisting of insulated metal panels and concrete block. The building has a swimming pool, men's and women's lockers, and a storage area.

The swimming pool is heated and ventilated by a H&V Unit. The locker rooms and storage area are also heated and ventilated by a H&V Unit.

The following table describes the HVAC equipment serving Building 6940.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
H&V-1	H&V Unit	H&V-1 provides heating and ventilating for the swimming pool area; (20 hp and 24,800 cfm)	Fair condition
H&V-2	H&V Unit	H&V-2 provides heating and ventilating for the locker rooms and storage area; (5 hp and 7,000 cfm)	Fair condition -pneumatic actuator on OA damper is missing
BLR-1	HW Boiler	2,800,000 Btuh (output) HW boiler serves H&V-1, H&V-2, and swimming pool water heat exchanger	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1	Fair condition
HWP-2	HW pump	1 hp pump serves H&V-1	Fair condition
HWP-3	HW pump	1 hp pump serves H&V-2	Fair condition

4.56.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
H&V-2	H&V Unit	Replace pneumatic actuator on OA damper	223

4.56.3 Proposed HVAC System Replacement

The H&V Unit serving the swimming pool area in Building 6940 was considered for replacement with a heat recovery unit (HRU). The following equipment and materials are included in the proposed HVAC system replacement:

- HRU with humidity and space temperature controls will replace the H&V Unit.
- Exhaust ductwork will be installed to exhaust air out through the roof.
- Roof outlet will be installed for exhaust air.
- Existing OA ductwork will remain; HRUs will be connected to the OA ductwork.

Method of Analysis

The EZDOE computer model for Building 8069 swimming pool area was used to evaluate the energy savings. The proposed HVAC system replacement for Building 8069 is similar to Building 6940. The analysis proceeded as follows:

- The computer model for the Building 8069 swimming pool area was used for the baseline computer model.
- The baseline computer model was modified to simulate the HRU. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings natural gas and electricity. The energy savings from Building 8069 were prorated on a square foot basis to Building 6940.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	706
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	7,727
Total Annual Energy Cost Savings	\$40,381
Investment Cost	\$199,226
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$0
Savings-to-Investment Ratio (SIR)	3.61
Simple Payback (yrs)	4.93

4.56.4 Recommendations

The HVAC system component for repair and the proposed HVAC system replacement are recommended.



4.57 BUILDING 8069 (INDOOR SWIMMING POOL AND GYMNASIUM)

4.57.1 HVAC System Existing Conditions

Building 8069 is a 25,620 sq ft, two-story building. The building was built in 1980 and is constructed of face brick and concrete block. The building has a swimming pool, raquetball courts, exercise room, weight training room, locker rooms, and a basketball gymnasium.

The swimming pool is heated and ventilated by four H&V Units, and has an exhaust fan that removes excess humid air. The raquetball courts, exercise room, and weight training room are heated and cooled by two SZ AHUs. The men's and women's locker rooms on the first floor are heated and ventilated by a H&V Unit. The basketball gymnasium is heated and ventilated by four H&V Units.

The following table describes the HVAC equipment serving Building 8069.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
H&V-1 thru H&V-4	H&V Unit	H&V Units provide heating and ventilating for the basketball gymnasium (6,750 cfm at 3 hp each)	Fair condition
H&V-5 thru H&V-8	H&V Unit	H&V Units provide heating and ventilating for the swimming pool area; (4,500 cfm at 2 hp each)	Fair condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the swimming pool area along the exterior glass wall	Fair condition
H&V-9	H&V Unit	H&V Unit provides heating and ventilating for the first floor locker rooms; (8,000 cfm at 5 hp)	Fair condition
EF-1	Exhaust Fan	EF-1 provides exhaust air from the first floor locker rooms; (8,000 cfm at 1-1/2 hp)	Fair condition
AHU-1	SZ	SZ AHU provides heating and cooling for the second floor exercise room; (5,190 cfm at 3 hp)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling for the raquetball courts; (2,125 cfm at 1-1/2 hp)	Fair condition
	Chilled Water	Chilled Water is provided by a Central Chiller Plant	
	Steam	Steam is provided by a Central Boiler Plant	

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
CV-1	Steam/HW convertor	CV-1 provides HW for H&V-1 thru H&V-9, AHU-1, AHU-2, and RAD-1	Fair condition
HWP-1	HW pump	7-1/2 hp pump serves CV-1, H&V-1 thru H&V-9, AHU-1, AHU-2, and RAD-1	Fair condition

4.57.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.57.3 Proposed Dehumidification Heat Recovery Unit

A pool dehumidification heat recovery unit (DHRU) was evaluated for the proposed HVAC system replacement of the H&V Units serving the swimming pool area.

The DHRU has two modes of operation, when outside air is above 55 F dewpoint and when outside air is below 55 F dewpoint. In other words, the DHRU operates in either cooling mode or heating mode.

During the heating mode, the DHRU heat recovery unit exchanges heat energy from the exhaust air to the incoming fresh air. The result is a warm dry airstream of incoming fresh air. An auxillary heating coil is used as required to supply heated air to the space. The pool water is heated by an auxillary water heater during this mode.

During the cooling mode, the DHRU heat recovery unit precools 50% of a mixture of fresh air and return air, before it goes through a dehumidification coil. This air then goes through the other side of the heat exchanger where its temperature is increased by absorbing heat energy from precooling the air. The other 50% of the air is then mixed with the conditioned air and passes through a reheat coil to increase the air temperature. The reheat coil is part of the refrigeration cycle heat rejection (similar to an air cooled condenser). Warm dry air is then delivered to the pool space. The heat absorbed during the refrigeration cycle is also used to heat the pool water. Any excess heat beyond the reheat coil and the pool water heating requirements is rejected to the outside air by an air cooled condenser.

Method of Analysis

The energy use during the heating and cooling modes were analyzed using the following:

- EZDOE computer model for Building 8069.
- Manufacturer's computer program for sizing and selection.

- Hand calculations.

The analysis proceeded as follows:

- The computer model for the Building 8069 swimming pool area was used for the baseline computer model.
- The baseline computer model was modified to simulate the heat recovery unit of the DHRU used for the pool space heating only. The modified baseline is the ECO model.
- The manufacturer's computer program was used to calculate the energy use associated with dehumidification of the pool space and to calculate the energy associated with pool water heating.
- A hand calculation was done to estimate the baseline energy use for pool water heating.
- The baseline computer model energy use and the baseline energy use for pool water heating were added together to find the total energy use for the existing equipment.
- The ECO model energy use for the heat recovery unit was added to the energy use calculated by the manufacturer's computer program for dehumidification of the pool space and pool water heating. This represents the total energy use of the DHRU.
- The DHRU energy use was subtracted from the baseline energy use to find the energy savings associated with the operation of the DHRU.
- A construction cost was developed for the DHRU system.
- The energy savings and the construction cost were entered into a LCCA worksheet

Energy Savings and Economic Analysis

The LCCA calculation revealed that this option for the proposed HVAC system replacement was not economically feasible, with a simple payback of 24.5 years and an SIR of 0.82. The calculations and backup data for this analysis are presented in Appendix D.

4.57.4 Heat Recovery Unit

The H&V Units serving the swimming pool area were then considered for replacement with heat recovery units (HRUs). The following equipment and materials are included in the proposed HVAC system replacement:

- Two HRUs with humidity and space temperature controls will replace four H&V Units.
- Exhaust ductwork will be installed to exhaust air out through the roof.
- Roof outlet will be installed for exhaust air.
- Existing OA ductwork will remain; HRUs will be connected to the OA ductwork.

Method of Analysis

The EZDOE computer model for Building 8069 swimming pool area was used to evaluate the energy savings. The analysis proceeded as follows:

- The computer model for the Building 8069 swimming pool area was used for the baseline computer model.
- The baseline computer model was modified to simulate the HRU. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	295
Annual Electric Demand Savings (\$)	0
Annual Natural Gas Savings (MBtu)	3,223
Total Annual Energy Cost Savings	\$16,840
Investment Cost	\$173,802
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$35,706
Savings-to-Investment Ratio (SIR)	1.90
Simple Payback (yrs)	9.33

4.57.5 Recommendations

The proposed HRU is recommended.



4.58 BUILDING 722 (FLIGHT SIMULATOR)

4.58.1 HVAC System Existing Conditions

Building 722 is a 7,000 sq ft, combination one-story and two-story building. The building was built in 1975 and is constructed of concrete block. The one-story (front) part of the building has three administration offices, a classroom, a maintenance shop, latrines, and storage. The two-story (back) part of the building contains the flight simulator room and the mechanical equipment rooms (the HVAC equipment on the mezzanine level and the hydraulic pump room on the ground level).

The one-story (front) part of the building is heated and cooled by a SZ AHU. The two-story flight simulator room is heated and cooled by a SZ AHU. The flight simulators are cooled by a VAV AHU and the flight simulator computers are cooled by a small SZ AHU.

The following table describes the HVAC equipment serving Building 722.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	VAV	VAV with 4 VAV boxes and fan volume control provides cooling for the flight simulators; 100% RA (20 hp and 15,590 max. cfm, 4,000 min. cfm)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling to the flight simulator room; (10 hp and 7,500 cfm)	Fair condition
AHU-3 and RAF-1	SZ	SZ AHU provides heating and cooling to the admin. offices, classroom, maint. shop, and latrines, (5 hp and 4,050 cfm); RAF-1 serves AHU-3 (5 hp and 3,000 cfm)	Fair condition
AHU-4	Air Conditioning Unit	AC Unit provides cooling to flight simulator computer equipment; 6,400 cfm at 3 hp	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	60 Ton chiller serves AHU-1, AHU-2, and AHU-3	Fair condition
CWP-1	CW pump	5 hp pump serves AHU-1, AHU-2, AHU-3, and CH-1	Fair condition
CH-2	Reciprocating w/ Air Cooled Cond.	16 Ton chiller serves AHU-4	Fair condition
CWP-2	CW pump	1/2 hp pump serves AHU-4 and CH-2	Fair condition
BLR-1	HW Boiler	480,100 Btuh (output) HW boiler serves AHU-1, AHU-2, and AHU-3	Fair condition
HWP-1	HW pump	3 hp pump serves AHU-1, AHU-2, and UHs	Fair condition

4.58.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition and are not in need of repair.

4.58.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 722 were not considered for replacement.

4.58.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.59 BUILDING 724 (FLIGHT SIMULATOR)

4.59.1 HVAC System Existing Conditions

Building 724 is a 13,190 sq ft, combination one-story and two-story building. The building was built in 1988 and is constructed of face brick and concrete block. The second-story has insulated metal panel walls. The building has administration offices, a classroom, a maintenance shop, breakroom, latrines, storage, and mechanical equipment rooms in the one-story part of the building. The two-story part of the building is located at the center and contains the flight simulator room.

The one-story part of the building is heated and cooled by a MZ AHU. The two-story flight simulator room is heated and cooled by a SZ AHU. The flight simulator computers are cooled by a two AC Units.

The following table describes the HVAC equipment serving Building 724.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling for the admin. offices, classroom, maint. shop, breakroom, and latrines, (7.5 hp and 6,200 cfm)	Good condition
AHU-2	SZ	SZ AHU provides heating and cooling to the flight simulator room; (7.5 hp and 6,000 cfm)	Good condition
AHU-3 and AHU-4	Air Conditioning Unit	AC Units provide cooling to the flight simulator computer equipment	Good condition
CH-1 and CH-2	Reciprocating w/ Air Cooled Cond.	25 Ton chillers (each) serve AHU-1 and AHU-2	Good condition
CWP-1	CW pump	3 hp pump serves AHU-1, AHU-2, CH-1, and CH-2	Good condition
CH-3 and CH-4	Reciprocating w/ Air Cooled Cond.	35 Ton chillers (each) serve AHU-3 and AHU-4	Good condition
CWP-2	CW pump	1 hp pump serves AHU-3, AHU-4, CH-3 and CH-4	Good condition
BLR-1	HW Boiler	360,000 Btuh (output) HW boiler serves AHU-1 and AHU-2	Good condition
HWP-1	HW pump	1/2 hp pump serves AHU-1, AHU-2, and BLR-1	Good condition

4.59.2 HVAC System Components for Repair

The HVAC system components were observed to be in good condition and are not in need of repair.

4.59.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 724 were not considered for replacement.

4.59.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.60 BUILDING 7739 (MOVING TARGET SIMULATOR)

4.60.1 HVAC System Existing Conditions

Building 7739 is a 4,075 sq ft, combination one-story and two-story building. The building was built in 1969 and is constructed of concrete block and insulated metal panel walls. The building has an administration office, a classroom, a maintenance shop, a toilet, a storage, and a mechanical equipment room in the one-story part of the building. The two-story part of the building contains the moving target simulator room.

The entire building (except for the toilet) is heated and cooled by a three zone MZ AHU. HW finned tube radiation provides heating in the administration office, toilet, and hallway.

The following table describes the HVAC equipment serving Building 7739.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling for the entire building, except for the toilet; (5 hp and 7,064 cfm)	Poor condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the admin. office, toilet, and hallway	Fair condition
ACCU-1	Air Cooled Condensing Unit	20 Ton chiller serves AHU-1	Fair condition
BLR-1	HW Boiler	308,000 Btuh (output) HW boiler serves AHU-1 and RAD-1	Fair condition - some rust on exterior jacket
HWP-1	HW pump	1/12 hp pump serves AHU-1	Fair condition
HWP-2	HW pump	1/12 hp pump serves RAD-1 and BLR-1	Fair condition

4.60.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-1	MZ	Replace 3 pneumatic zone damper actuators; replace pneumatic actuator on OA/RA dampers	893

4.60.3 Proposed HVAC System Replacement

The MZ AHU serving Building 7739 was considered for replacement with a VAV AHU. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHU with VSD will replace the MZ AHU.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- Existing ductwork will be modified to better serve the moving target simulator zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7806 HVAC system replacement was used to evaluate the energy savings. The proposed HVAC system replacement for Building 7806 is similar to Building 7739. The energy savings from Building 7806 were prorated on a square foot basis to Building 7739.

The analysis proceeded as follows:

- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	101
Annual Electric Demand Savings (\$)	283
Annual Natural Gas Savings (MBtu)	(37)
Total Annual Energy Cost Savings	\$1,359
Investment Cost	\$27,484
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$14,830
Savings-to-Investment Ratio (SIR)	1.23
Simple Payback (yrs)	13.09

4.60.4 Recommendations

The HVAC system component for repair is recommended.



4.61 BUILDING 6620 (COMMUNITY ACTIVITIES CENTER)

4.61.1 HVAC System Existing Conditions

Building 6620 is a 31,740 sq ft, two-story building, built in 1962 and is constructed of face brick and concrete block. The building was originally constructed for use as the NonCommissioned Officers Club with Open Mess. It is currently used as the Community Activities Center and has a large ballroom, dining room, kitchen area, and an office area on the west wing.

A seven zone MZ AHU provides heating and cooling to the west wing office area. Additional heating in the west wing office area is provided by HW perimeter radiation units along the building perimeter. The ballroom and dining room are heated and cooled each by SZ AHUs. The kitchen area is heated and ventilated by a H&V Unit.

The following table describes the HVAC equipment serving Building 6620.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling to the west wing office area (7-1/2 hp and 12,910 cfm)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling to the ballroom (7-1/2 hp and 9,600 cfm)	Poor condition - fan bearings noisy
AHU-3	SZ	SZ AHU provides heating and cooling to the dining room (5 hp and 8,800 cfm)	Fair condition
H&V-1	H&V Unit	H&V Unit provides heating and ventilation to the kitchen area (5 hp and 10,500 cfm)	Fair condition
RAD-1	HW finned tube radiation units	Perimeter radiation units provide additional heating in the west wing office area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	120 Ton chiller serves AHU-1, AHU-2, and AHU-3	Fair condition
CWP-1 and CWP-2	CW pump	7-1/2 hp pump (ea.) serves CH-1, AHU-1, AHU-2, and AHU-3; CWP-2 is a standby	Fair condition
BLR-1	Steam boiler	Steam boiler serves the AHUs, H&V Unit, and CV-1	Fair condition
BP-1	Boiler feed pump	1/2 hp pump serves BLR-1	Poor condition - pump seals leaking
BLR-2	Steam boiler	Steam boiler serves the AHUs, H&V Unit, and CV-1 (standby)	Fair condition
BP-2	Boiler feed pump	1/2 hp pump serves BLR-1	Poor condition - pump seals leaking
CV-1	STM/HW Convertor	CV-1 provides HW to RAD-1	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.61.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the estimated costs for repair.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost (\$)
AHU-2	SZ	Replace fan bearings -bearings very noisy; Replace 7-1/2 hp fan motor - bearings very noisy	389
BP-1	Boiler feed pump	Replace pump seals - leaking (15 gpm at 46 ft. of head)	208
BP-2	Boiler feed pump	Replace pump seals - leaking (15 gpm at 46 ft. of head)	209
Total Repair Cost			806

4.61.3 Proposed HVAC System Replacement

The SZ AHUs serving Building 6620 were considered for replacement with VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts; the existing ductwork will remain.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

The MZ AHU serving the west wing office area in Building 6620 was considered for conversion to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- VSD controller will be installed on the MZ AHU to control the supply fan speed.
- VAV terminal units will be installed on the zone supply air ducts.

- Pneumatic actuators on the hot and cold deck zone dampers will be retrofitted with electric actuators. A summer-winter changeover control switch will be installed to close the retrofitted zone dampers on the hot and cold decks during heating or cooling seasons. The hot and cold deck dampers will be interconnected so the hot deck damper will close during the cooling season and the cold deck damper will close during the heating season.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

Method of Analysis

The approach used for calculating energy savings for the SZ AHU systems replacement included using a computer program to simulate a typical building. The EZDOE computer model for Building 7086 was used to evaluate energy savings. Building 7086 (Unit Chapel) assembly area is similar in use to the ball room and dining room areas of Building 6620.

The analysis proceeded as follows:

- The computer model for Building 7086 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement systems - the VAV AHUs with VSDs. The VSD controls were set to vary the supply air volume down to 20%. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
 - Economic life is 20 years.
 - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

The approach used for calculating energy savings for the MZ AHU system conversion included using a computer program to simulate a typical building. The EZDOE computer model for Building 7108 (Battalion Admin. and Classroom) was used to evaluate energy savings. Building 7108 is similar in use to the administration office area in Building 6620.

The analysis proceeded as follows:

- The computer model for Building 7108 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the MZ AHU converted to a VAV AHU with a VSD. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. Energy savings were prorated on a sq ft basis to Building 6620.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	478
Annual Electric Demand Savings (\$)	539
Annual Natural Gas Savings (MBtu)	199
Total Annual Energy Cost Savings	\$7,138
Investment Cost	\$47,075
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$30,326
Savings-to-Investment Ratio (SIR)	2.99
Simple Payback (yrs)	5.44

The energy savings and economic analysis for the proposed HVAC system replacement for the MZ AHU conversion are included in Appendix D. The results of the analysis are presented in the following table.

Convert MZ AHU to VAV AHU

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	176
Annual Electric Demand Savings (\$)	(122)
Annual Natural Gas Savings (MBtu)	(9)
Total Annual Energy Cost Savings	\$1,972
Investment Cost	\$13,076
Annual Maintenance Cost Savings	\$0
Non-recurring Cost Savings	\$0
Savings-to-Investment Ratio (SIR)	2.40
Simple Payback (yrs)	6.63

4.61.4 Recommendations

The proposed HVAC system replacements are recommended.



4.62 BUILDING 7604 (GENERAL INSTRUCTION BUILDING)

4.62.1 HVAC System Existing Conditions

Building 7604 is a 13,500 sq ft, one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It was originally built for use as a Five Company Mess Hall and was recently converted to a General Instruction Building. The building has four classrooms at the center with administration offices along the perimeter.

The mechanical equipment room is located in a mezzanine above the administration offices. Two MZ AHUs provide heating and cooling to the administration offices and classrooms. A SZ AHU provides heating and cooling to administration offices also.

The following table describes the HVAC equipment serving Building 7604.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling to the west half of the building; (5 hp and 6,000 cfm)	Good condition
AHU-2	MZ	MZ AHU provides heating and cooling to the east half of the building; (5 hp and 6,000 cfm)	Good condition
AHU-3	SZ	SZ AHU provides heating and cooling to admin. offices on the south perimeter of the building (2 hp and 2,000 cfm)	Good condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves AHU-1, AHU-2, and AHU-3	Fair condition
CWP-1	CW pump	2 hp pump serves CH-1, AHU-1, AHU-2, AHU-3	Fair condition
BLR-1	HW Boiler	HW boiler serves AHU-1, AHU-2, and AHU-3 (648,000 Btuh output)	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1, AHU-1, AHU-2, and AHU-3	Fair condition
HWP-2	HW pump	2 hp pump serves BLR-1, AHU-1, AHU-2, and AHU-3 (standby)	Fair condition

4.62.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition. The HVAC system components are not in need of repair.

4.62.3 Proposed HVAC System Replacement

The HVAC systems serving Building 7604 were not considered for replacement.

4.62.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.63 BUILDING 7656 (GENERAL INSTRUCTION BUILDING)

4.63.1 HVAC System Existing Conditions

Building 7656 is a 13,500 sq ft, one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It was originally built for use as a Five Company Mess Hall and was recently converted to a General Instruction Building. The building has four classrooms at the center with administration offices along the perimeter.

The mechanical equipment room is located in a mezzanine above the administration offices. Two MZ AHUs provide heating and cooling to the administration offices and classrooms.

The following table describes the HVAC equipment serving Building 7656.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling to the west half of the building; (5 hp and 7,000 cfm)	Good condition
AHU-2	MZ	MZ AHU provides heating and cooling to the east half of the building; (5 hp and 7,000 cfm)	Good condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves AHU-1, AHU-2, and AHU-3	Fair condition
CWP-1	CW pump	2 hp pump serves CH-1, AHU-1, AHU-2, AHU-3	Fair condition
BLR-1	HW Boiler	HW boiler serves AHU-1, AHU-2, and AHU-3; (estimated at 3,500,000 Btuh output, original Steam boiler at 6,900,000 Btuh output was converted to HW)	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1, AHU-1, AHU-2, and AHU-3	Fair condition
HWP-2	HW pump	2 hp pump serves BLR-1, AHU-1, AHU-2, and AHU-3 (standby)	Fair condition

4.63.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition. The HVAC system components are not in need of repair.

4.63.3 Proposed HVAC System Replacement

The HVAC systems serving Building 7656 were not considered for replacement.

4.63.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

5. SUMMARY OF HVAC UPGRADE

5.1 GENERAL

This section summarizes the results of the evaluation performed for the HVAC systems in the 70 buildings included in this feasibility study. A summary of HVAC system components for repair and a summary of proposed HVAC system replacements are provided.

5.2 SUMMARY OF HVAC SYSTEM COMPONENTS FOR REPAIR

HVAC system components in need of repair were found in 40 of the 70 buildings evaluated. The HVAC system components for repair are summarized in Table 5-1 on page 5-2.

5.3 SUMMARY OF PROPOSED HVAC SYSTEM REPLACEMENTS

The proposed HVAC system replacements were analyzed for 39 of the 70 buildings evaluated. The proposed HVAC system replacements are summarized in Table 5-2 on page 5-3.

Some of the 39 buildings evaluated required analysis of more than one HVAC system per building. A total of 51 proposed HVAC system replacements were analyzed.

The economic analysis summary for the proposed HVAC system replacements is presented in Table 5-3 on page 5-5. The proposed HVAC system replacements are ranked by SIR, from highest SIR to lowest SIR. The economic analysis for the proposed HVAC system replacements revealed that 32 of the 51 HVAC systems analyzed qualified for the ECIP funding program (simple paybacks below 10 years and SIRs greater than 1.25).

TABLE 5-1
SUMMARY OF HVAC COMPONENTS FOR REPAIR

TAB	BLDG NO.	BLDG NAME	DESCRIPTION OF HVAC COMPONENTS FOR REPAIR	REPAIR COST (\$)
Admin. Buildings 1	222	ADMIN GEN PURP	DAMPER ACTUATOR	223
	302	FINANCE ADMIN	FAN BEARING	91
	313	CIV PERS BLDG	CONDENSER COIL (PLUS COVER)	797
	7636	REGIMENTAL HQ BLDG	CONTROL VALVE 2-1/2"	1,050
	8056	DET DAY ROOM	PUMP, 3/4 HP	744
Admin. & Supply Buildings 2	7602	ADMIN & SUPPORT BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7608	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7652	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7658	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
Barracks Buildings 3	227	ENL BARRACKS W/AS	CONTROL VALVE 1" & CONTROL VALVE 1-1/2"	506
	402	ENL BARRACKS W/AS	CONTROL VALVE 1"	300
	7612	ENL BARRACKS W/AS	PUMP SEAL	208
	7614	ENL BARRACKS W/AS	PUMP SEAL	625
	7810	ENL BARRACKS W/O DIN	PUMP SEAL	417
	7814	ENL BARRACKS W/O DIN	PUMP, 2 HP & PUMP SEAL	1,219
	8002	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8012	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8014	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8038	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8040	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8042	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8048	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8050	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8052	SR ENL QTRS	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
Dining Facilities 7	7245	ENL PERS DIN	CONTROL VALVE 2" & DAMPER ACTUATOR	872
	7606	ENL PERS DIN	CONTROL VALVE 2" & PUMP, 2 HP	1,863
	7654	ENL PERS DIN	CONTROL VALVE 2" & DAMPER ACTUATOR	872
	7804	ENL PERS DIN	DAMPER ACTUATOR	223
	7856	ENL PERS DIN	FAN MOTOR, 1-1/2 HP, FAN MOTOR, 5 HP & PATCH DUCTWORK	564
Maintenance Shops 8	723	MNT HANGAR COMB	PUMP SEAL, CONDENSATE PUMP GASKET & CONDENSATE SHUT-OFF CONTROLS	1,439
	727	MNT HANGAR COMB	DAMPER ACTUATOR, PUMP SEAL, CONDENSATE PUMP GASKET, CONDENSATE SHUT-OFF CONTROLS & PUMP MOTOR, 1/3 HP	1,935
	741	MNT HANGAR COMB	REPLACE FOUR STEAM HEATING COILS, 980,000 BTUH CAPACITY EACH	4,975
	820	TAC EQUIP SHOP	CONTROL VALVE 1-1/2", PUMP MOTOR, 10 HP & PUMP SEAL	2,094
	8390	TAC EQUIP SHOP	DAMPER ACTUATOR, CONTROL VALVE 1" & CONTROL VALVE 3/4"	1,975
Recreation & Retail Facilities 9	202	PHYS FITNESS CTR	CONDENSER COIL (PLUS COVER)	979
	6914	EXC MAIN RETL	CONTROL VALVE 1-1/2", CONTROL VALVE 2", CONTROL VALVE 1-1/4" & DAMPER ACTUATOR	2,098
	6940	INDOOR SWIM POOL	DAMPER ACTUATOR	223
	7485	BOWLING ALLEY	VARIABLE SPEED DRIVE W/ CONTRLER, 10HP	3,459
Simulator Building 10	7739	MOVING TARGET SIMULATOR BLDG	DAMPER ACTUATOR	893
Training Building 11	6620	COMMUN ACT CTR	FAN MOTOR, 7-1/2 HP & PUMP SEAL	806

**TABLE 5-2
PROPOSED HVAC SYSTEMS FOR REPLACEMENT**

TAB	BLDG NO.	BLDG NAME	EXISTING HVAC SYSTEM TYPE	PROPOSED HVAC SYSTEM TYPE
Admin. Buildings 1	222	ADMIN GEN PURP	Win. ACs / P. Rad. / SZ	Replace SZ with VAV AHU
	5000	FIRE STATION	MZ / H&V / Gas IRs	Replace MZ with 3 Furnance AC Units, Replace Boiler with smaller Boiler, and Replace ACCU with 3 smaller ACCUs
	7178	MOTOR POOL ADMIN	Gas-Fired UHs / Win. ACs	Replace 3 Win. ACs with small SZ w/ DX coil
Admin. & Supply Buildings 2	7243	ADMIN & SUPPLY BLDG	Win. AC / P. Rad. / FCs in building addition	Replace 15 Win. ACs with 5 small SZs w/ DX coils
	7602	ADMIN & SUPPLY BLDG	SZ (Clg Only) / P. Rad. (All)	Replace existing SZs with new SZs
	7608	ADMIN & SUPPLY BLDG	SZ (Clg Only) / P. Rad. (All)	Replace existing SZs with new SZs
	7652	ADMIN & SUPPLY BLDG	SZ (Clg Only) / P. Rad. (All)	Replace existing SZs with new SZs
	7658	ADMIN & SUPPLY BLDG	SZ (Clg Only) / P. Rad. (All)	Replace existing SZs with new SZs
Barracks Buildings 3	227	ENL BARRACKS W/AS	MZs	Replace MZs and SZs with VAV AHUs
	402	ENL BARRACKS W/AS	MZs	Replace MZs and SZ with VAV AHUs
	410	ENL BARRACKS W/AS	MZs	Replace MZs with VAV AHUs
	7404	ENL BARRACKS W/O DIN	MZ / P. Rad.	Convert 2 MZs to VAVs
	7612	ENL BARRACKS W/AS	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
	7614	ENL BARRACKS W/AS	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
	7616	ENL BARRACKS W/AS	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
	7810	ENL BARRACKS W/O DIN	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
Battalion Buildings 4	7814	ENL BARRACKS W/O DIN	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
	7806	BN HQ BLDG	SZs / P. Rad.	Replace SZs with VAV AHUs
Chapel Buildings 5	8025	BN ADMIN & CLRM	MZs / P. Rad.	Convert MZs to VAVs
	3	POST CHAPEL	SZ	Replace SZ, H&V, Stm Boiler and Cooling Tower with VAV AHU, HW Boiler, and Water Chiller
Dental Clinic Buildings 6	7086	UNIT CHAPEL	SZ / FCs	Replace SZ with VAV AHU
	602	DENTAL CLINIC	DD	Convert DD to DD w/ VAV
	7665	DENTAL CLINIC	MZ	Convert MZ to VAV
Dining Facilities 7	7670	DENTAL CLINIC	DD	Convert DD to DD w/ VAV
	7245	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
	7606	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
	7654	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
	7804	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
Maintenance Shops 8	7856	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
	741	MNT HANGAR COMB	UHs / P. Rad.	Replace Industrial Type UHs with Gas-fired Infrared Radiant Tube System
	820	TAC EQUIP SHOP	SZ / UHs / P. Rad.	Replace HW UHs with Gas-fired Infrared Radiant Tube System; Down size HW Boiler
Recreation & Retail Facilities 9	7176	MOTOR POOL MNT SHOP	UHs	Replace UHs and Steam Boiler with IR Tube Heating System
	202	PHYS FITNESS CTR	SZ / UHs	Replace two Industrial Type Unit Heaters in Basketball Gym with four H&V Units
	7485	BOWLING ALLEY	DD / VAV	Convert DD to DD w/ VAV
	6914	EXC MAIN RETL	SZs / MZs	Convert two MZs to VAVs
	6940	INDOOR SWIM POOL	H&V / SZ	Replace H&Vs with Heat Recovery Units
Simulator Building 10	8069	INDOOR SW POOL/GYM	H&Vs / SZ	Replace H&V with Heat Recovery Unit
	7739	MOVING TARGET SIMULATOR BLDG	MZ / FCs	Replace MZ with VAV AHU
Training Building 11	6620	COMMUN ACT CTR	SZ / MZ / H&V	Replace 2 SZs with VAV AHUs; Convert MZ to VAV

**TABLE 5-3
ECONOMIC SUMMARY FOR PROPOSED HVAC SYSTEM REPLACEMENT**

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND KW COST SAVINGS (\$/yr)	TOTAL ENERGY SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON-RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
7485	BOWLING ALLEY	Convert DD to DD w/ VAV	(293)	488	196	(\$1,205)	\$5,907	\$850	\$5,552	\$0	\$0	\$15,055	2.71	5.61
7665	DENTAL CLINIC	Convert MZ to VAV	(107)	301	194	(\$440)	\$3,637	\$637	\$3,834	\$0	\$0	\$12,210	3.18	4.85
7670	DENTAL CLINIC	Convert DD to DD w/ VAV	(173)	889	716	(\$713)	\$10,760	\$958	\$11,006	\$0	\$0	\$40,355	3.67	4.26
602	DENTAL CLINIC	Convert DD to DD w/ VAV	(132)	681	548	(\$546)	\$8,237	\$1,242	\$8,934	\$0	\$0	\$35,342	3.96	3.94
6940	INDOOR SWIM POOL	Replace H&V with Heat Recovery Unit	7,727	706	8,434	\$31,836	\$8,545	\$0	\$40,381	\$0	\$0	\$199,226	4.93	3.61
7245	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7606	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7654	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7804	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7856	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
6620	COMMUN ACT CTR	Replace SZ AHUs with VAV AHUs	199	478	677	\$821	\$5,778	\$539	\$7,138	\$0	\$30,326	\$47,075	5.44	2.99
7404	ENL BARRACKS WAS	Convert two MZs to VAVs	0	364	364	\$0	\$4,402	\$378	\$4,780	\$0	\$0	\$26,055	5.45	2.90
410	ENL BARRACKS WAS	Replace MZs with VAV AHUs	(730)	997	267	(\$3,008)	\$12,061	\$1,309	\$10,362	\$0	\$51,813	\$77,512	5.98	2.59
402	ENL BARRACKS WAS	Replace MZs and SZ with VAV AHUs	(730)	997	267	(\$3,008)	\$12,061	\$1,309	\$10,362	\$0	\$49,221	\$78,851	6.15	2.52
5000	FIRE STATION	Replace MZ with 3 Furnance AC Units, Replace Boiler with smaller Boiler, and Replace ACCU with 3 smaller ACCUs	196	82	278	\$808	\$991	(\$47)	\$1,752	\$652	\$72,986	\$41,284	6.82	2.48
7245	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$72,585	7.35	2.47
6620	COMMUN ACT CTR	Convert MZ to VAV	(9)	176	167	(\$35)	\$2,129	(\$122)	\$1,972	\$0	\$0	\$13,076	6.63	2.40
7804	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$78,207	7.92	2.29
7856	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$78,207	7.92	2.29
227	ENL BARRACKS WAS	Replace MZs and SZs with VAV AHUs	(852)	1,163	311	(\$3,510)	\$14,071	\$1,527	\$12,089	\$0	\$70,248	\$111,119	7.12	2.18
7806	BN HQ BLDG	Replace SZs with VAV AHUs	(95)	263	168	(\$392)	\$3,183	\$735	\$3,526	\$0	\$23,323	\$34,973	7.45	2.13
7086	UNIT CHAPEL	Replace SZ with VAV AHU	122	92	214	\$504	\$1,108	\$183	\$1,794	\$0	\$12,554	\$19,280	7.96	2.09
222	ADMIN GEN PURP	Replace SZ with VAV AHU	(127)	260	133	(\$523)	\$3,145	\$809	\$3,431	\$0	\$14,214	\$31,811	7.68	2.03
7606	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$89,312	9.05	2.01
7654	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$89,312	9.05	2.01
8089	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery Unit	3,223	295	3,517	\$13,277	\$3,563	\$0	\$16,840	\$0	\$35,706	\$173,802	9.33	1.90
7178	MOTOR POOL ADMIN	Replace 3 Win. ACs with small SZ w/ DX coil	0	52	52	\$0	\$628	\$826	\$1,454	(\$141)	\$4,071	\$12,511	8.25	1.89
7245	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74

**TABLE 5-3
ECONOMIC SUMMARY FOR PROPOSED HVAC SYSTEM REPLACEMENT**

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND KW COST SAVINGS (\$/yr)	TOTAL ENERGY COST SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON-RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
7606	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7654	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7804	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7856	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7176	MOTOR POOL MNT SHO	Replace UHs and Steam Boiler with IR Tube Heating System	83	28	112	\$343	\$344	\$0	\$688	\$600	\$24,734	\$27,000	10.70	1.56
3	POST CHAPEL	Replace SZ, H&V, Slim Boiler and Cooling Tower with VAV AHU, HW Boiler, and Water Chiller	212	136	348	\$874	\$1,649	\$131	\$2,653	\$724	\$48,583	\$68,200	11.75	1.42
820	TAC EQUIP SHOP	Replace HW UHs with Gas-fired Infrared Radiant Tube System; Down size HW Boiler	104	11	115	\$427	\$133	\$0	\$560	\$370	\$43,700	\$37,546	12.05	1.42
7739	MOVING TARGET SIMULATOR BLDG	Replace MZ with VAV AHU	(37)	101	65	(\$151)	\$1,227	\$283	\$1,359	\$0	\$14,830	\$27,484	13.09	1.23
741	MNT HANGAR COMB	Replace Industrial Type UHs with Gas-fired Infrared Radiant Tube System	626	213	839	\$2,578	\$2,583	\$0	\$5,161	\$600	\$63,690	\$142,228	15.90	1.07
7602	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
7608	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
7652	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
7658	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
6914	EXC MAIN RETL	Convert two MZs to VAVs	(4)	145	141	(\$18)	\$1,757	(\$18)	\$1,722	\$0	\$0	\$29,431	17.09	0.93
7612	ENL BARRACKS WVAS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7614	ENL BARRACKS WVAS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7616	ENL BARRACKS WVAS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7810	ENL BARRACKS WVAS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7814	ENL BARRACKS WVAS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery, Dehumidification, and Pool Heating Unit	3,223	(559)	2,663	\$13,277	(\$6,769)	\$0	\$6,508	\$0	\$35,706	\$202,172	24.38	0.82
7243	ADMIN & SUPPLY BLDG	Replace 15 Win. ACs with 5 small SZs w/ DX coils	0	50	50	\$0	\$600	\$790	\$1,390	(\$704)	\$19,638	\$43,596	26.13	0.64
8025	BN ADMIN & CLRM	Convert MZs to VAVs	0	65	65	\$0	\$791	(\$112)	\$679	\$0	\$0	\$17,282	25.45	0.63
202	PHYS FITNESS CTR	Replace two Industrial Type Unit Heaters in Basketball Gym with four H&V Units	148	20	167	\$609	\$236	\$48	\$894	\$0	\$17,611	\$64,001	36.08	0.48

6. RECOMMENDATIONS

6.1 RECOMMENDATIONS FOR HVAC SYSTEM COMPONENTS FOR REPAIR

The HVAC system components are recommended for repair to restore the existing HVAC systems to their intended operating condition. Some of the HVAC systems evaluated overlapped between the analyses for HVAC repair and replacement. Those HVAC systems which qualified economically for replacement were removed from the HVAC components for repair list. The buildings removed from the repair list include Buildings 222, 227, 402, 7245, 7606, 7654, 7804, and 7856. The total cost for the recommended HVAC system components for repair is \$56,887. The recommended HVAC system components for repair are presented in Table 6-1 on page 6-2.

6.2 RECOMMENDATIONS FOR HVAC SYSTEM REPLACEMENTS

The HVAC systems are recommended for replacement with more efficient HVAC systems. The 32 proposed HVAC system replacements which qualified for the ECIP funding program are recommended to be submitted for project funding. The recommended HVAC system replacements are presented in Table 6-2 on page 6-3.

The HVAC systems not qualifying for the ECIP funding program were not recommended for replacement. The nonrecommended HVAC system replacements are presented in Table 6-3 on page 6-5.

TABLE 6-1
RECOMMENDED HVAC COMPONENTS FOR REPAIR

TAB	BLDG NO.	BLDG NAME	DESCRIPTION OF HVAC COMPONENTS FOR REPAIR	REPAIR COST (\$)
Admin. Buildings 1	302	FINANCE ADMIN	FAN BEARING	91
	313	CIV PERS BLDG	CONDENSER COIL (PLUS COVER)	797
	7636	REGIMENTAL HQ BLDG	CONTROL VALVE 2-1/2"	1,050
	8056	DET DAY ROOM	PUMP, 3/4 HP	744
Admin. & Supply Buildings 2	7602	ADMIN & SUPPORT BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7608	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7652	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7658	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
Barracks Buildings 3	7612	ENL BARRACKS W/AS	PUMP SEAL	208
	7614	ENL BARRACKS W/AS	PUMP SEAL	625
	7810	ENL BARRACKS W/O DIN	PUMP SEAL	417
	7814	ENL BARRACKS W/O DIN	PUMP, 2 HP & PUMP SEAL	1,219
	8002	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8012	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8014	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8038	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8040	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8042	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8048	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8050	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8052	SR ENL QTRS	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
Maintenance Shops 8	723	MNT HANGAR COMB	PUMP SEAL, CONDENSATE PUMP GASKET & CONDENSATE SHUT-OFF CONTROLS	1,439
	727	MNT HANGAR COMB	DAMPER ACTUATOR, PUMP SEAL, CONDENSATE PUMP GASKET, CONDENSATE SHUT-OFF CONTROLS & PUMP MOTOR, 1/3 HP	1,935
	741	MNT HANGAR COMB	REPLACE FOUR STEAM HEATING COILS, 980,000 BTUH CAPACITY EACH	4,975
	820	TAC EQUIP SHOP	CONTROL VALVE 1-1/2", PUMP MOTOR, 10 HP & PUMP SEAL	2,094
	8390	TAC EQUIP SHOP	DAMPER ACTUATOR, CONTROL VALVE 1" & CONTROL VALVE 3/4"	1,975
Recreation & Retail Facilities 9	202	PHYS FITNESS CTR	CONDENSER COIL (PLUS COVER)	979
	6914	EXC MAIN RETL	CONTROL VALVE 1-1/2", CONTROL VALVE 2", CONTROL VALVE 1-1/4" & DAMPER ACTUATOR	2,098
	6940	INDOOR SWIM POOL	DAMPER ACTUATOR	223
	7485	BOWLING ALLEY	VARIABLE SPEED DRIVE W/ CONTRLER, 10 HP	3,459
Simulator Building 10	7739	MOVING TARGET SIMULATOR BLDG	DAMPER ACTUATOR	893
Training Building 11	6620	COMMUN ACT CTR	PUMP SEAL	417
TOTAL REPAIR COST				\$56,887

**TABLE 6-2
RECOMMENDED HVAC SYSTEM REPLACEMENTS**

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND KW/COST SAVINGS (\$/yr)	TOTAL ENERGY SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON-RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
7485	BOWLING ALLEY	Convert DD to DD w/ VAV	(293)	488	196	(\$1,205)	\$5,907	\$850	\$5,552	\$0	\$0	\$15,055	2.71	5.61
7665	DENTAL CLINIC	Convert MZ to VAV	(107)	301	194	(\$440)	\$3,637	\$637	\$3,834	\$0	\$0	\$12,210	3.18	4.85
7670	DENTAL CLINIC	Convert DD to DD w/ VAV	(173)	889	716	(\$713)	\$10,760	\$958	\$11,006	\$0	\$0	\$40,355	3.67	4.26
602	DENTAL CLINIC	Convert DD to DD w/ VAV	(132)	681	548	(\$546)	\$8,237	\$1,242	\$8,934	\$0	\$0	\$35,342	3.96	3.94
6940	INDOOR SWIM POOL	Replace H&V with Heat Recovery Unit	7,727	706	8,434	\$31,836	\$8,545	\$0	\$40,381	\$0	\$0	\$199,226	4.93	3.61
7245	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7606	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7654	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7804	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
7856	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	\$14,465	\$1,250	\$332	\$16,047	\$0	\$30,377	\$90,334	5.14	3.49
6620	COMMUN ACT CTR	Replace SZ AHUs with VAV AHUs	199	478	677	\$821	\$5,778	\$539	\$7,138	\$0	\$30,326	\$47,075	5.44	2.99
7404	ENL BARRACKS W/O DIN	Convert two MZs to VAVs	0	364	364	\$0	\$4,402	\$378	\$4,780	\$0	\$0	\$26,055	5.45	2.90
410	ENL BARRACKS W/AS	Replace MZs with VAV AHUs	(730)	997	267	(\$3,008)	\$12,061	\$1,309	\$10,362	\$0	\$51,813	\$77,512	5.98	2.59
402	ENL BARRACKS W/AS	Replace MZs and SZ with VAV AHUs	(730)	997	267	(\$3,008)	\$12,061	\$1,309	\$10,362	\$0	\$49,221	\$78,851	6.15	2.52
5000	FIRE STATION	Replace MZ with 3 Furnance AC Units, Replace Boiler with smaller Boiler, and Replace ACCU with 3 smaller ACCUs	196	82	278	\$808	\$991	(\$47)	\$1,752	\$652	\$72,986	\$41,284	6.82	2.48
7245	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$72,585	7.35	2.47
6620	COMMUN ACT CTR	Convert MZ to VAV	(9)	176	167	(\$35)	\$2,129	(\$122)	\$1,972	\$0	\$0	\$13,076	6.63	2.40
7804	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$78,207	7.92	2.29
7856	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$78,207	7.92	2.29
227	ENL BARRACKS W/AS	Replace MZs and SZs with VAV AHUs	(852)	1,163	311	(\$3,510)	\$14,071	\$1,527	\$12,089	\$0	\$70,248	\$111,119	7.12	2.18
7806	BN HQ BLDG	Replace SZs with VAV AHUs	(95)	263	168	(\$392)	\$3,183	\$735	\$3,526	\$0	\$23,323	\$34,973	7.45	2.13
7086	UNIT CHAPEL	Replace SZ with VAV AHU	122	92	214	\$504	\$1,108	\$183	\$1,794	\$0	\$12,554	\$19,280	7.96	2.09
222	ADMIN GEN PURP	Replace SZ with VAV AHU	(127)	260	133	(\$523)	\$3,145	\$809	\$3,431	\$0	\$14,214	\$31,811	7.68	2.03
7606	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$89,312	9.05	2.01
7654	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	\$6,295	(\$1,338)	\$0	\$4,957	(\$181)	\$101,942	\$89,312	9.05	2.01
8089	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery Unit	3,223	295	3,517	\$13,277	\$3,563	\$0	\$16,840	\$0	\$35,706	\$173,802	9.33	1.90
7178	MOTOR POOL ADMIN	Replace 3 Win. ACs with small SZ w/ DX coil	0	52	52	\$0	\$628	\$826	\$1,454	(\$141)	\$4,071	\$12,511	8.25	1.89
7245	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74

**TABLE 6-2
RECOMMENDED HVAC SYSTEM REPLACEMENTS**

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND KW COST SAVINGS (\$/yr)	TOTAL ENERGY COST SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON-RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
7806	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7654	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7804	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
7856	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	(\$1,151)	\$3,477	\$381	\$2,707	\$0	\$21,050	\$33,387	8.80	1.74
TOTALS FOR ENERGY SAVINGS, COST SAVINGS, AND INVESTMENTS			32,019	9,679	41,698	\$131,911	\$117,151	\$14,698	\$263,762	(\$394)	\$1,131,307	\$1,995,765	-	-

**TABLE 6-3
NONRECOMMENDED HVAC SYSTEM REPLACEMENTS**

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND KW COST SAVINGS (\$/yr)	TOTAL ENERGY SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON-RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
7176	MOTOR POOL MINT SHO	Replace UHs and Steam Boiler with IR Tube Heating System	83	28	112	\$343	\$344	\$0	\$688	\$600	\$24,734	\$27,000	10.70	1.56
3	POST CHAPEL	Replace SZ, H&V, Strm Boiler and Cooling Tower with VAV AHU, HW Boiler, and Water Chiller	212	136	348	\$874	\$1,649	\$131	\$2,653	\$724	\$48,583	\$68,200	11.75	1.42
820	TAC EQUIP SHOP	Replace HW UHs with Gas-fired Infrared Radiant Tube System; Down size HW Boiler	104	11	115	\$427	\$133	\$0	\$560	\$370	\$43,700	\$37,546	12.05	1.42
7739	MOVING TARGET	Replace MZ with VAV AHU	(37)	101	65	(\$151)	\$1,227	\$283	\$1,359	\$0	\$14,830	\$27,484	13.09	1.23
741	MNT HANGAR COMB	Replace Industrial Type UHs with Gas-fired Infrared Radiant Tube System	626	213	839	\$2,578	\$2,583	\$0	\$5,161	\$600	\$63,690	\$142,228	15.90	1.07
7602	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
7608	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
7652	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
7658	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	\$0	\$302	\$213	\$515	\$0	\$20,550	\$24,083	15.62	1.07
6914	EXC MAIN RETL	Convert two MZs to VAVs	(4)	145	141	(\$18)	\$1,757	(\$18)	\$1,722	\$0	\$0	\$29,431	17.09	0.93
7612	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7614	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7616	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7810	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
7814	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	\$8,964	\$1,151	(\$1,233)	\$8,881	\$5,147	\$179,196	\$434,560	18.90	0.91
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery, Dehumidification, and Pool Heating Unit	3,223	(559)	2,663	\$13,277	(\$6,769)	\$0	\$6,508	\$0	\$35,706	\$202,172	24.38	0.82
7243	ADMIN & SUPPLY BLDG	Replace 15 Win. ACs with 5 small SZs w/ DX coils	0	50	50	\$0	\$600	\$790	\$1,390	(\$704)	\$19,638	\$43,596	26.13	0.64
8025	BN ADMIN & CLRM	Convert MZs to VAVs	0	65	65	\$0	\$791	(\$112)	\$679	\$0	\$0	\$17,282	25.45	0.63
202	PHY'S FITNESS CTR	Replace two Industrial Type Unit Heaters in Basketball Gym with four H&V Units	148	20	167	\$609	\$236	\$48	\$894	\$0	\$17,611	\$64,001	36.08	0.48

6.3 RECOMMENDED ENERGY RETROFIT PROJECTS FOR HVAC UPGRADE

Five energy retrofit projects were identified for HVAC upgrade by the Fort Riley Public Works Energy Branch. These projects were recommended for funding under the Federal Energy Management Program (FEMP). The five projects are presented in Table 6-4.

Table 6-4. HVAC Energy Retrofit Projects Recommended for FEMP

Project No.	Project Description
Project No. 1 Upgrade HVAC Systems in Dental Clinics (see TAB 6)	
	<ul style="list-style-type: none"> • Building 602 - Convert DD AHU to DD VAV AHU • Building 7665 - Convert MZ AHU to VAV AHU • Building 7670 - Convert DD AHU to DD VAV AHU
Project No. 2 Upgrade HVAC Systems in Dining Facilities (see TAB 7)	
	<ul style="list-style-type: none"> • Building 7245 <ul style="list-style-type: none"> - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
	<ul style="list-style-type: none"> • Building 7606 <ul style="list-style-type: none"> - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
	<ul style="list-style-type: none"> • Building 7654 <ul style="list-style-type: none"> - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
Project No. 3 Upgrade HVAC Systems in Indoor Swimming Pool Buildings (see TAB 9)	
	<ul style="list-style-type: none"> • Building 6940 - Replace H&V with HRU • Building 8069 - Replace H&Vs with HRUs
Project No. 4 Upgrade HVAC Systems in Bowling Alley and Community Activities Center	
	<ul style="list-style-type: none"> • Building 7485 (Bowling Alley) - Convert DD AHU to DD VAV AHU (see TAB 9)
	<ul style="list-style-type: none"> • Building 6620 (Community Activities Center) <ul style="list-style-type: none"> - Replace SZ AHUs with VAV AHUs - Convert MZ AHU to VAV AHU (see TAB 11)

Project No.	Project Description
Project No. 5	Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin, and Battalion Headquarters
	<ul style="list-style-type: none"> • Building 5000 (Fire Station) BLR (see TAB 1) <ul style="list-style-type: none"> - Replace MZ AHU with three Furnace Air Conditioners - Replace ACCU with three Smaller ACCUs - Replace HW Boiler with Smaller Modular HW
	<ul style="list-style-type: none"> • Building 7086 (Unit Chapel) (see TAB 5) <ul style="list-style-type: none"> - Replace SZ AHU with VAV AHU
	<ul style="list-style-type: none"> • Building 7178 (Motor Pool Admin) (see TAB 1) <ul style="list-style-type: none"> - Replace three WACs with SZ AHU and ACCU
	<ul style="list-style-type: none"> • Building 7806 (Battalion Headquarters) (see TAB 4) <ul style="list-style-type: none"> - Replace SZ AHU with VAV AHUs

DD 1391 Forms and LCCAs for each of the five FEMP energy retrofit projects are presented in Appendix F. The energy savings and economic parameters for the projects are presented in Table 6-5 on page 6-8.

TABLE 6-5
ECONOMIC SUMMARY FOR ENERGY RETROFIT PROJECTS

FEMP ENERGY RETROFIT PROJECT FOR HVAC UPGRADE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS (\$/yr)	ELEC. COST SAVINGS (\$/yr)	DEMAND kW COST SAVINGS (\$/yr)	TOTAL ENERGY COST SAVINGS (\$/yr)	ANNUAL MAINT. SAVINGS (\$/yr)	NON- RECURRING SAVINGS (\$)	TOTAL INVESTMENT (\$)	SIMPLE PAYBACK (yrs)	SIR
Project No. 1 Dental Clinics (Bldgs 602, 7665, 7670)	(412)	1,871	1,459	(\$1,697)	\$22,639	\$2,837	\$23,779	\$0	\$0	\$87,908	3.70	4.22
Project No. 2 Dining Facilities (Bldgs 7245, 7606, and 7654)	14,280	837	15,117	\$58,834	\$10,128	\$2,139	\$71,100	(\$543)	\$460,107	\$622,370	6.65	2.66
Project No. 3 Indoor Swimming Pools (Bldgs 6940 and 8069)	10,950	1,001	11,951	\$45,114	\$12,112	\$0	\$57,226	\$0	\$35,706	\$373,029	6.32	2.81
Project No. 4 Bowling Alley and Comm. Act. Center (Bldgs 7485 and 6620)	(103)	1,142	1,039	(\$424)	\$13,818	\$1,267	\$14,661	\$0	\$30,326	\$75,206	4.65	3.41
Project No. 5 Fire Station, Unit Chapel, Motor Pool Admin, and Bn HQ (Bldgs 5000, 7086, 7178, and 7806)	223	489	712	\$919	\$5,917	\$1,697	\$8,533	\$511	\$112,934	\$108,048	7.36	2.23

APPENDIX A
SCOPE OF WORK

CEMRKED-MF

23 AUGUST 1994
REVISED 24 AUGUST 1994
REVISED 25 AUGUST 1994

GENERAL SCOPE OF WORK
FOR
FEASIBILITY STUDY FOR
HVAC UPGRADE
FORT RILEY, KANSAS

Performed as part of the
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

RHVAC24

SCOPE OF WORK
FEASIBILITY STUDY
FOR
HVAC UPGRADE, FORT RILEY, KS

TABLE OF CONTENTS

1. BRIEF DESCRIPTION OF WORK
2. GENERAL
3. PROJECT MANAGEMENT
4. SERVICES AND MATERIALS
5. PROJECT DOCUMENTATION
 - 5.1 ECIP Projects
 - 5.2 Non-ECIP Projects
 - 5.3 Nonfeasible ECOs
6. DETAILED SCOPE OF WORK
7. WORK TO BE ACCOMPLISHED
 - 7.1 Review Data for Existing HVAC Systems
 - 7.2 Perform a Limited Site Survey
 - 7.3 Evaluate Selected Buildings
 - 7.4 Provide Programming or Implementation Documentation
 - 7.5 Submittals, Presentations and Reviews

ANNEXES

- A - DETAILED SCOPE OF WORK
- B - REQUIRED DD FORM 1391 DATA
- C - EXECUTIVE SUMMARY GUIDELINE

1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

1.1 Review for general information the available design, construction, and operation data for the HVAC systems.

1.2 Perform a detailed site survey of selected buildings or facilities to verify construction features, electrical and mechanical equipment, occupancy, and mode of operation for energy analysis; and to evaluate the condition of existing HVAC equipment and controls. A total of 70 buildings will be evaluated for HVAC repair and replacement. The 70 buildings will be selected based on data collected during the UEMCS field survey and in consultation with the Fort Riley DEH.

1.3 Evaluate failed or failing HVAC systems identified during the survey to determine necessary repairs. Provide recommendations with potential energy savings and economic feasibility for replacing the systems in approximately 30% of the buildings with more efficient systems.

1.4 Provide complete programming or implementation documentation for all recommended projects.

1.5 Prepare a comprehensive report to document the work performed, the results and the recommendations.

2. GENERAL

2.1 This study is intended to identify and evaluate replacement of failed or failing HVAC equipment. All buildings shall be prioritized according to simple payback and need.

2.2 The information and analysis outlined herein are considered to be minimum essentials for adequate performance of this study.

2.3 For the purposes of this scope of work, an Energy Conservation Opportunity (ECO) is defined as the replacement of the HVAC system or controls within a particular building or facility. A project is defined as the replacement of the HVAC system or controls in one or more buildings/facilities.

2.4 The AE shall ensure that all ECOs pertaining to HVAC system replacement which will reduce the energy consumption or cost of operation of the installation have been considered and

documented per the detailed scope of work. Only one replacement HVAC system will be evaluated for each existing HVAC system.

2.5 The study shall include the energy consuming buildings or facilities listed in paragraph 1.2 above. Field work and calculations may be reduced somewhat by building repetition.

2.6 Computer modeling will be used to determine the energy savings of ECOs for typical buildings. The typical buildings are listed in the Detailed Scope of Work, Annex A. The results of these calculations may be applied to buildings which are similar to the typical buildings. To be considered similar, a building must be essentially identical to the typical building in size, floor plan, mechanical equipment, type of construction, condition of equipment and occupancy. If a building is identical to a typical building in all respects except that the occupancy has been changed (e.g., a barracks converted into offices) the building should not be considered similar. In some cases, differences in physical orientation may not allow buildings to be treated as similar; but it is anticipated that in most cases, physical orientation will not be a significant factor. Modeling will be done using a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The program will use established weather data files and may perform calculations on a true hour-by-hour basis or may condense the weather files and the number of calculations into several "typical" days per month. The Detailed Scope of Work, Annex A, lists programs that are acceptable to the Contracting Officer. If the AE desires to use a different program, it must be submitted for approval with a sample run, an explanation of all input and output data, and a summary of program methodology and energy evaluation capabilities. This requirement to use computer modeling for typical buildings applies only to heated and air conditioned or air-conditioned-only buildings which exceed 8,000 square feet or heated-only buildings in excess of 20,000 square feet.

2.7 The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from DAIM-FDF-U, dated 10 JAN 1994, establishes criteria for ECIP projects and shall be used for performing the economic analyses of all ECOs and projects. Construction cost escalation for DD Form 1391 submission shall be calculated using the guidelines contained in AR 415-17 and the latest Tri-Service MCP Index. The Tri-Service MCP Index, when

updated, is contained in the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) bulletin.

2.8 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar buildings/projects into larger packages which will qualify for ECIP or OMA funding, and determining, in coordination with installation personnel, the appropriate packaging and implementation approach for all feasible ECOs.

2.9 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).

2.10 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.

3. PROJECT MANAGEMENT

3.1 Project Managers. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative.

3.2 Installation Assistance. The Commanding Officer at each installation will designate an individual who will serve as the point of contact for obtaining information and assisting in establishing contacts with the proper individuals and organizations as necessary to accomplish the work required under this contract.

3.3 Public Disclosures. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE and/or the designated representative(s) shall be required

to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5 Site Visits, Inspections, and Investigations. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7 Interviews. The AE and the Government's representative shall conduct entry and exit interviews with the Director of Engineering and Housing before starting work at the installation and after completion of the field work. The Government's representative shall schedule the interviews at least two weeks in advance.

3.7.1 Entry. The entry interview shall thoroughly describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

- a. Schedules.

- b. Names of energy analysts who will be conducting the site survey.
- c. Proposed working hours.
- d. Support requirements from the Director of Engineering and Housing.

3.7.2 Exit. The exit interview shall include a thorough briefing describing the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the Director of Engineering and Housing.

4. SERVICES AND MATERIALS. All services, materials (except those specifically enumerated to be furnished by the Government), labor, superintendence and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. PROJECT DOCUMENTATION. All energy conservation opportunities or projects which the AE has considered shall be included in one of the following categories and presented in the report as such:

5.1 ECIP Projects. An ECIP project is one that proposes new construction or a retrofit of an existing facility for the purpose of conserving energy. In an ECIP project, savings may come from energy, demand, operations and maintenance, or a combination of the above. To qualify as an ECIP project, an ECO or project must have a construction cost estimate greater than \$300,000, a Savings to Investment Ratio greater than or equal to 1.25 and a simple payback period of less than ten years. The AE shall check with the installation for guidance. The overall project and each discrete part of the project shall have a SIR greater than 1.25. For all projects meeting the above criteria, complete programming documentation will be required. Programming documentation shall consist of a DD Form 1391, and life cycle cost analysis summary sheet(s) with necessary backup data to verify the numbers presented. A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one building are combined.

5.2 Non-ECIP Projects. Projects which normally do not meet ECIP criteria, but which have an overall SIR greater than 1.25 shall be documented. The life cycle cost analysis summary sheet shall be completed for all ECOs or projects. Each shall be analyzed to determine if it is feasible even if it does not meet ECIP criteria. For ECOs or projects in this category, the life

cycle cost analysis summary sheet, completely filled out, with all the necessary backup data to verify the numbers presented, a complete description of the project and the simple payback period shall be included in the report. Additionally, these projects shall have the necessary documentation prepared, in accordance with the requirements of the Government's representative, for one of the following categories:

a. **O & M Energy Projects:** An O & M Energy project is one that results in needed maintenance or repair to an existing facility, or replaces a failed or failing existing facility, and also results in energy savings. The criteria are similar to the criteria for ECIP projects, i.e., \$ 300,000 construction cost, $SIR > 1.25$, and simple payback period of less than ten years. In addition, if the project would replace a system or equipment that is considered 'failed or failing' due solely to obsolete technology or inefficiency, the equipment to be replaced must have been in use for at least three years; and the simple payback period must be three years or less.

b. **Low Cost/No Cost Projects.** These are projects which the Director of Engineering and Housing can perform using his resources.

5.3 **Nonfeasible ECOS.** All buildings/facilities which the AE has considered but which are not feasible for replacement of controls or connection to the new UEMCS shall be documented in the report with reasons and justifications showing why they were rejected.

6. **DETAILED SCOPE OF WORK.** The detailed Scope of Work is contained in Annex A.

7. **WORK TO BE ACCOMPLISHED.**

7.1 **Review Data for Existing HVAC SYSTEMS.** The AE shall review for general information the construction drawings and specifications and the manufacturer's drawings and operations and maintenance manuals for the existing HVAC systems. This review should acquaint the AE with the details used in the existing system. Much of the information the AE may need to perform his evaluations will be contained in this data.

7.2 **Perform a Limited Site Survey.** The AE shall determine, based on information provided by the installation, which buildings are "typical" and which are "similar" as defined in paragraph 2.6. If different buildings are basically similar but

the condition of the equipment is different, the buildings are not similar. A limited field survey of all buildings listed in the detailed scope of work shall be conducted to verify and/or adjust the list of "typical" and similar" buildings. A detailed field investigation will then be made of all "typical" buildings using the outline provided in the detailed scope of work. This will include evaluating the condition of existing HVAC equipment and controls. The AE shall document his site survey on forms developed for the survey and submit these completed forms as part of the report. Testing is not required.

7.3 Evaluate ECOS/Projects. The ECOS and projects identified in paragraph 1.3 shall be analyzed in detail to determine their feasibility. Savings-to-Investment Ratios (SIRs) shall be determined using current ECIP guidance. The AE shall provide all data and calculations needed to support these analyses. All assumptions shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be in an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings or sketches, and input/output (I/O) summary sheets shall also be included. A life cycle cost analysis summary sheet shall be prepared for each ECO or project and shall be included as part of the supporting data. Provide a LCID summary for each recommended project developed.

7.4 Provide Programming or Implementation Documentation. For projects or ECOS developed during this study, complete programming or implementation documentation shall be prepared by the AE.

7.4.1 Programming Documentation. For buildings or projects which meet ECIP criteria and which the installation wants to submit as an ECIP project, complete programming documentation shall be prepared. Complete programming documentation consists of DD Form 1391, and supporting data. These forms shall be separate from the narrative report. They shall be bound similarly to the final report in a manner which will facilitate repeated disassembly and reassembly. A maximum of five 1391's shall be furnished.

7.4.1.1 Military Construction Project Data (DD Form 1391). These documents shall be prepared in accordance with AR 415-15 and the supplemental requirements in Annex B. A complete DD Form 1391 shall be prepared for each project. The form shall include a statement that the project results from an EEAP study.

Documents shall be complete as required for submission to higher DA headquarters. These programming documents will require review and signatures by the proper installation personnel. All documents shall be completed except for the required signatures. The Installation will enter the Forms into the DD 1391 processor.

7.4.2 Implementation Documentation. For feasible projects or ECOS which do not meet ECIP criteria, implementation documentation shall be prepared. Each feasible project or ECO shall be individually packaged, fully documented, and included as a separate section in the volume containing the programming documentation. Each project or ECO shall have a complete description of work to be done, economic justifications, sketches, I/O summary sheets, and other backup data included as a section in the report. The documentation required will be as determined by the Government's representative. Documentation required will be in the categories listed in paragraph 5.2. For low cost/no cost projects which the Director of Engineering and Housing personnel can perform, the following information shall be provided:

- a. Brief description of the project.
- b. Brief description of the reasons for the modification.
- c. Specific instructions for performing the modification.
- d. Estimated dollar and energy savings per year.
- e. Estimated manhours and labor and materials costs. Costs shall be calculated for the current calendar year and so marked. Manhours shall be listed by trade.

Separate sheets for each project showing the above information shall be prepared and included in the report.

7.5 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs and dividers shall clearly and distinctly divide sections, sub-sections, and appendices. All pages shall be numbered. The AE shall give a formal presentation of all but the final submittal to installation, command, and other Government personnel. The AE shall prepare slides or view graphs showing the results of the study to date for his presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask

questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. The AE shall provide the comments from all reviewers and written notification of the action taken on each comment to all reviewing agencies within three weeks after the review meeting. It is anticipated that each presentation and review conference will require approximately one working day. The presentation and review conferences will be at the installation on the date(s) agreeable to the Director of Engineering and Housing, the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.5.1 Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOS. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. I/O summary sheets and calculations showing energy and dollar savings and SIRs of all ECOS/projects shall be included. The simple payback period of all ECOS/projects shall be calculated and shown in the report. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. During the review period, the Government's representative shall coordinate with the Director of Engineering and Housing and provide the AE with direction for packaging or combining ECOS for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. A sample implementation document (DD Form 1391, sketches and manufacturers data, I/O summary sheets, life cycle cost analysis summary sheet and supporting data) for one project shall be submitted with this submittal for review and approval. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.5.2 Prefinal Submittal. The AE shall prepare and submit the prefinal report when all sections of the report are complete.

The AE shall submit the Scope of Work for the installation studied and any modifications to the Scope of Work as an appendix to the submittal. The report shall integrate all aspects of the study. The report shall list the recommended projects in order of descending SIR. The synergistic effects of all of the applications programs proposed for any particular building shall have been determined and the results of the original calculations adjusted accordingly. Completed programming and implementation documents for all recommended projects shall be included. The programming and implementation documents shall be ready for review and signature by the installation commander. The prefinal report, separately bound Executive Summary and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The prefinal submittal shall be arranged to include (a) a separately bound Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex C for minimum requirements), (b) the narrative report containing a copy of the Executive Summary at the beginning of the volume and describing in detail what was accomplished and the results of this study, (c) appendices to include the detailed calculations and all backup material and (d) the programming and implementation documentation. A list of all projects and ECOS developed during this study shall be included in the Executive Summary and shall include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost.

7.5.3 Final Submittal. Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation and review conference shall be incorporated into the final report. These revisions or corrections may be in the form of replacement pages, which may be inserted in the prefinal report, or complete new volumes. Pen and ink changes or errata sheets will not be acceptable. If replacement pages are to be issued, it shall be clearly stated with the prefinal submittal that the submitted documents will be changed only to comply with the comments made during the prefinal conference and that the volumes issued at the time of the prefinal submittal should be retained. Failure to do so will require resubmission of complete volumes. If new volumes are submitted, they shall be in standard three-ring binders and shall contain all the information presented in the prefinal report with any necessary changes made. Detailed instructions of what to do.

with the replacement pages should be securely attached to the replacement pages.

ANNEX A

DETAILED SCOPE OF WORK

1. LOCATION

a. GENERAL DESCRIPTION. The Architect Engineer (AE) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, and travel as required in connection with the feasibility study for the below identified project in accordance with the contract and all furnished instructions:

INSTALLATION
Ft. Riley, Ks.

DESCRIPTION
HVAC UPGRADE

b. The project consists of evaluating failed or failing HVAC systems identified during the survey to determine necessary repairs in buildings to be determined in accordance with paragraph 1.2 of the General Scope of Work.

2. AUTHORIZATION. The feasibility study for this project is authorized by Memorandum CEMP-ET, Subject: Energy Engineering Analysis Program (EEAP)-FY94 dated 7 December 1993 and Memorandum CESAM-EN-DM, Subject: Energy Analysis Program (EEAP), FY94 Supplemental Program for Kansas City District dated 10 August 1994. The AE shall make reference to this authority in the study.

3. STUDY INSTRUCTIONS. If the Design Manuals, Guide Specifications, and/or Project Engineering Instructions do not cover a specific condition in question, the AE shall contact the Contracting Officer before proceeding. If there is a conflict in Engineering Instructions or other reference data, such questions or conflicts should be brought to the attention of the Contracting Officer before proceeding.

4. THE INSTALLATION REPRESENTATIVE for this contract will be Mr. Keith Jevons, Project Manager, Directorate of Engineering and Housing, telephone number 913-239-2044. The Kansas City District Project Manager will be Mr. Robert Miller, telephone number 816-426-7348. The Authorized Representative of the Contracting Officer will be Mr. Michael Whitacre, telephone number 816-426-2781.

5. COMPLETION AND PAYMENT SCHEDULE: The following schedule shall be used as a guide in approving payments on this contract. The interim report shall be due not later than 180 days after Notice to Proceed. The prefinal report shall be due not later than 30 days after the interim report review conference. The final report shall be due not later than 21 days after the prefinal review conference.

<u>MILESTONE</u>	<u>PERCENT OF CONTRACT AMOUNT AUTHORIZED FOR PAYMENT</u>
Entry Interview	10
Completion of Field Work	25
Receipt of Interim Submittal	75
Completion of Interim Presentation & Review	85

6. METHOD OF PAYMENT.

a. Title I. The AE shall prepare and submit to the US Army Engineer District, Kansas City, partial payment estimates in accordance with the attachment entitled "Instructions for Completion of ENG Form 93." All partial payments shall be based on work completed as of the 15th day of the report month and shall be submitted to the office of the Contracting Officer by the 18th day of the month. Payment under this contract, for which property or services are provided in a series of partial executions or deliveries, will be made within 30 days after receipt of an invoice which has been properly executed by the AE.

b. Additional Conferences. Payment for furnishing the services of technically qualified representatives to attend additional conferences, when so requested in writing by the Contracting Officer, will be made at a rate per hour for the discipline involved plus travel expenses computed in accordance with Government Joint Travel Regulations in effect at the time travel is performed and actual cost of transportation.

7. THE SIMULATION PROGRAMS acceptable for use in this study are listed below. Any substitutes must be submitted and approved as outlined in the basic scope of work.

- a. Building Loads and System Thermodynamics (BLAST)
- b. DOE 2.1D
- c. Carrier E20 or Hourly Analysis Program (HAP)

d. Trane Air-Conditioning Economics (TRACE)

e. Beacon

8. A COMPUTER PROGRAM titled Life Cycle Costing in Design (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOS. The AE is encouraged to obtain and use this computer program or may use their in-house program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. Telephone number is (217) 333-3977 or (800) 842-5278.

9. FACILITY SURVEY

The Architect-Engineer (AE) shall conduct a survey of the buildings and building systems listed in accordance with Appendix B of TM 5-815-2 and as described herein. Each building/system shall be observed while operating. This survey shall include and document the following items:

a. Nameplate information such as manufacturer, horsepower, voltage, current, and other required data shall be recorded for each piece of equipment to be included in the system.

b. Conditions/deficiencies shall be noted for each piece of equipment and each piping or duct system.

10. AUTOMATED REVIEW MANAGEMENT SYSTEM (ARMS).

a. The AE, as a part of this scope of work, shall interface with and utilize the Corps of Engineers Automated Review Management System for this project. The AE will receive one copy of CESP-K-PAM 1110-1-2, AE Response Package (User's Manual) describing the communications software, optimum hardware requirements and access procedures. The necessary software is included with the manual. Minimum requirements are an IBM-XT or compatible computer system running DOS 3.0 or later, with 640 kilobyte (KB) RAM, at least a 20 megabyte (MB) hard disk and a 1200 or higher baud Hayes-compatible modem operating. Assistance can be received via a telephone hotline at 916-551-3126.

b. All design review comments and responses will be electronically transmitted from the Corps of Engineer, Missouri River Division, by the ARMS. Comments can be received at a

personal computer in the AE's office by use of ARMS software and a modem over telephone lines. The comments reside on the Missouri River Division computer. The AE can then download the review comments, respond to the comments, upload the comments back to the Division computer and forward responses to the Project Manager.

11. GOVERNMENT-FURNISHED DATA.

- a. "Energy Monitoring & Control Systems Technical Manual" TM 5-815-2/AFM 88-36/ NAVFAC DM 4.9
- b. AR 415-15 Military Construction, Army (MCA) Program Developement
- c. AR 415-20 Project Development and Design Approval
- d. Engineering Instructions (as applicable)
- e. Latest Tri-Service Cost Index.
- f. DAIM-FDF-U letter dated 10 January 1994, "Energy Conservation Investment Program (ECIP) Guidance".

12. SUBMITTAL REQUIREMENTS.

ORGANIZATION	COPIES REQUIRED (Correspondence); Interim & Prefinal Review (Final)		
Commander 1st Infantry Division (Mech) & Fort Riley ATTN: AFZN-DE-E/ Mr. Jevons Building 408 Fort Riley, Kansas 66442-5000	(1)	3***	(3)
District Engineer U.S. Army Engineer District, Kansas City ATTN: CEMRKED-MF(MILLER) 700 Federal Building Kansas City, Missouri 64106	(1)	3***	(3)
Division Engineer U.S. Army Engineer Division Missouri River ATTN: CEMRDMP-A(Jagasits) 12565 W. Center Road Omaha, NE 68144-3869	(1)	3***	(1)
Commander H.Q. Forscom ATTEN: AFPI-ENO/ Mr. Kapur Fort McPherson, Ga. 30330-6000	(1)	1	(1)
HQDA ODCSLOG ATTN: DALO-TSE (Maj. Wilson) Pentagon Washington, D.C. 20310-0561			(1)*
Commander U.S. Army Corps of Engineers ATTN: CEMP-ET (Mr. Gentil) 20 Massachusetts Avenue, NW Washington, DC 20314-1000		1*	(1)*

Commander (1)
U.S. Army Engineer District, Mobile
ATTN: CESAM-EN-DM (Mr. Battaglia)
P.O. Box 2288
Mobile, AL 36628-1000

1

(1)

Commander
U.S. Army Logistics Evaluation Agency
ATTN: LOEA-PL (Mr. Keath)
New Cumberland Army Depot
New Cumberland, PA. 17070-5007

(1)*

* Executive Summary only
*** Computer printout

BUILDINGS THAT ARE NOT NOW CONNECTED TO THE UEMCS SYSTEM
LISTED IN ORDER OF PRIORITY

BUILDING	OCCUPANCY	SQ FT	CONDITION	NOTE
7670	Dental Clinic	14,960	Fair	
7632*	Gymnasium	20,694	Fair	
7832	Gymnasium	20,694	Fair	
741	Maint Hanger Comb	38,898	Fair	
7665*	Dental Clinic	11,076	Fair	
602	Dental Clinic	11,557	Fair	
722	Flight Simulator	7,000	Poor	
724*	Flight Simulator	13,188	Good	
8063	Enl Pers Dine	18,313	Poor	
7024	Gymnasium	20,619	Fair	
223	Enlisted Barrack W/DAS	47,794	Poor 1	
727*	Mnt Hanger Comb	36,172	Good	
7622	Bn Admin & Clrm	12,380	Fair	
7824	Bn Admin & Clrm	12,246	Fair to Good	
7836	Bn Admin & Clrm	12,246	Fair to Good	
6914*	Exc Main Retl	63,930	Fair 5, 9	
7404	Enl Barracks W/O Dining	50,967	Fair	
7424	Enl Barracks W/O Dining	50,967	Fair	
6620	Commum Act Ctr	31,740	Fair 9	
7108	Bn Admin & Clrm	12,527	Good 6	
7109	Bn Admin & Clrm	13,535	Good	
7620	Bn Admin & Clrm	6,340	Fair	
7624	Bn Admin & Clrm	6,158	Fair	
8025	Bn Admin & Clrm	12,000	Poor	
8037	Bn Admin & Clrm	12,000	Poor	
7820	Bn Admin & Clrm	6,673	Fair	
8071	Rgt HQ Bldg	9,963	Poor	
817	Mnt Hanger Avum	40,061	Fair	
802	Bn Admin & Clrm	12,526	Good	
804	Rgt HQ Build	10,241	Good	
806	Comb AC-HTG Plant	1,000	Good	
808	Bn Admin & Clrm	12,526	Good	
810	Adm & Support Building	15,152	Good	
812	Adm & Support Building	23,559	Good	
814	Medical Facility	Not Listed	New	
7485	Bowling Alley	36,966	Very Poor	
7806	Bn HQ Bldg	13,493	Fair to Good	
223	Enl Bks W/DAS	47,794	Poor 1	
500	Post HQ Building	65,453	Fair to Good 9	
404	Enlisted Barrack W/DAS	35,718	Poor 1	
853	Mnt Hanger Avum	48,112	Fair	
840	Vehicle Mnt Shop Org.	9,152	Good	

206	Theater W/O Dressing Rm	10,754	Poor
200	Admin General Purp.	60,690	Fair to Good 9
7920	Veh Mnt Shop DS	124,553	Fair
751	AC Pts & TOE ST	9,834	Fair
210	Military Personel Building	58,448	Good 9
7243	Admin & Sup Bldg	17,829	Fair
7285	Clothing Sales	17,042	Fair
8069*	IN SW Pool/Gym	25,620	Fair 9
7253	Finance Admin Buldg	52,400	Good
202	Physical Fitness Ctr.	51,307	Fair
7630	Bn Admin & Clrm	6,158	Fair
7638	Bn Admin & Clrm	6,158	Fair
7270	Bn. HQ Bldg	6,130	Fair to Good
6918	Skill Development Center	11,507	Good
402	Enlisted Barracks W/AS	35,718	Poor
409*	Enlisted Barracks W/AS	32,883	Poor 2
410	Enlisted Barracks W/AS	32,883	Poor
411	Enlisted Barracks W/AS	32,883	Poor
6940	Indoor Swimming Pool	23,347	Poor 3
7350	Veh Mnt Shop Org	21,345	Fair
7500	Veh Mnt Shop Org	22,325	Good 9
7720	Veh Mnt Shop Org	22,325	Good 9
7740	Veh Mnt Shop Org	22,325	Good 9
7960	Veh Mnt Shop Org	20,245	Good 9
222	Admin Gen Purp	18,854	Fair
7450*	Regimental HQ Bldg	9,850	Fair
7636	Regimental HQ Bldg	9,850	Fair
7033	Bn Hqt Building	4,083	Fair
7866*	Theater w/ Dressing Rm.	11,098	Fair
7834	Regimental HQ Bldg	9,904	Good
8065	Clinic W/O Beds	3,848	Poor
8067	Exchange Branch	4,850	Poor
7520	Veh Mnt Shop Org	27,112	Good 9
7600	Veh Mnt Shop Org	17,163	Good 9
7780	Veh Mnt Shop Org	17,163	Good 9
7900	Veh Mnt Shop Org	20,943	Good 9
7940	Veh Mnt Shop Org	22,405	Good 9
301*	Finance Admininistration	32,947	Poor
302	Finance Admininistration	16,138	Poor
319	General Instruction Bldg	9,690	Poor
8410	Veh Mnt Shop Org	73,233	Fair
8330	Veh Mnt Shop Org	39,256	Fair
8370	Veh Mnt Shop Org	26,876	Fair
8380	Veh Mnt Shop Org	No Listing	Good
7640	Exchange Branch	4,876	Poor
7840	Exchange Branch	4,798	Good
7410*	Bn Admin & Clrm	12,599	Fair

1950	Salv & Surp Prop	42,480	Good
1980	Phys Fitness Center	24,968	Fair to Good
610	Enlisted Barracks W/AS	29,004	Good 1
7224	Enlisted Barracks W/AS	52,027	Fair
7230	Enlisted Barracks W/AS	52,027	Fair
7233	Enlisted Barracks W/AS	39,333	Fair
7305	App Instr Bldg	9,872	Fair
405*	Admin General Purpose	10,778	Poor
446	Off Open Dining	35,068	Fair 8
5800	Youth Center	No Listing	Good
6910	Exc Sp St Fac	2,525	Poor 9
7826	Clinic W/O Bed	3,841	Good
8021*	Adm & Support Building	23,676	Poor
8023	Adm & Support Building	23,676	Poor 4
8057	Adm & Support Building	23,676	Poor
8059	Adm & Support Building	23,676	Poor
512	Senior Enlisted Quarters	13,619	Poor 9
313	Civilian Personel Bldg	6,222	Fair
319	Civilian Personel Bldg	9,690	Fair
7602	Adm & Support Building	13,520	Fair
7608	Adm & Support Building	13,520	Fair
7652	Adm & Support Building	13,520	Fair
7658	Adm & Support Building	13,520	Fair
7802	Adm & Support Building	13,280	Fair
7808	Adm & Support Building	13,280	Fair
7852	Adm & Support Building	13,280	Fair
7858	Adm & Support Building	13,280	Fair
7432	Adm & Support Building	13,500	Fair
7264	Library Main	31,240	Fair
7626	Clinic W/O Beds	3,604	Fair
7826	Clinic W/O Beds	3,841	Fair
7086*	Unit Chapel	8,696	Poor to Fair
7865	Unit Chapel	8,718	Fair
7050	Enl Bk W/AS	39,675	Fair 9
7053	Enl Bk W/AS	39,675	Fair 9
403	Admin General (Design Prep)	18,151	Good 1
7034	Clinic W/O Beds	3,842	Fair
7739	Moving Target Sim Bldg	4,074	Poor
7044	Enl Bk W/O Din	52,027	Fair
7227	Enl Bk W/DAS	52,227	Fair
720	AF Ops Bldg	3,705	Fair
7031	Bn HQ Bldg	3,733	Fair
7046	Bn Classrooms	3,733	Fair
7604	Gen Inst Bldg	1,346	Good 6
7656*	Gen Inst Bldg	13,493	Good 6
5302*	Post Office	12,240	Fair
7245	Enlisted Personel Dine	13,998	Fair

214	Enlisted Barracks W/AS	35,821	Fair
227	Enlisted Barracks W/AS	32,303	Poor
7606*	Enlisted Persenel Dine	13,493	Fair
7654	Enlisted Persenel Dine	13,493	Fair
7804	Enlisted Persenel Dine	13,493	Fair
7854	Bn HQ Bldg	13,493	Fair
7856	Enlisted Persenel Dine	13,493	Poor
8010	Det Day Room	2,100	Poor
8046	Det Day Room	2,100	Fair
1470	AR Vehicle Maint. Shop	21,667	Good
7212	Co. HQ Bldg	19,320	Good
7218	Bn. HQ Bldg	12,625	Good
7220	Co. HQ Bldg	18,870	Fair
7048	Bn. HQ Bldg	2,604	Fair
7028	Bn Classrooms	3,733	Fair
7047	Bn. HQ Bldg	3,733	Poor
8008	Enlisted Barracks W/O Din	11,549	Poor
8014	Enlisted Barracks W/O Din	11,549	Poor
8040	Enlisted Barracks W/O Din	11,549	Poor
8048	Enlisted Barracks W/O Din	11,549	Poor
8050	Enlisted Barracks W/O Din	11,549	Poor
8054	Enlisted Barracks W/O Din	11,549	Poor
29	Red Cross Bldg	Not Government Owned	
6*	Post Chapel	6,230	Fair
3	Post Chapel	8,828	Fair
760	Bn HQ Bldg	7,364	Fair
727	Mnt Hangar Comb	36,152	Fair
509	Admin Gen Purpose	10,108	Good 9
8002*	Enlisted Barracks W/O Din	22,700	Poor
8006	Enlisted Barracks W/O Din	22,700	Poor
8012	Enlisted Barracks W/O Din	22,700	Poor
8020	Det Day Room	2,100	Poor
8038	Enlisted Barracks W/O Din	22,700	Poor
8042	Enlisted Barracks W/O Din	22,700	Poor
8052	Senior Enlisted Quarters	22,700	Poor
8056	Det Day Room	2,100	Poor
8044	Applied Inst Bldg	2,470	Poor
5000*	Fire Station	8,400	Very Poor
7610*	Enlisted Barracks W/AS	41,892	Fair to Good
7612	Enlisted Barracks W/AS	41,892	Fair to Good
7614	Enlisted Barracks W/AS	41,892	Fair to Good
7616	Enlisted Barracks W/AS	41,892	Fair to Good 9
7618	Enlisted Barracks W/O Din	41,892	Fair to Good 9
7642	Enlisted Barracks W/O Din	41,892	Fair 9
7644	Enlisted Barracks W/O Din	41,892	Fair 9
7646	Enlisted Barracks W/O Din	41,892	Good 9
7648	Enlisted Barracks W/O Din	41,892	Fair to Good 9

7650	Enlisted Barracks W/O Din	41,892	Good	9
7810	Enlisted Barracks W/O Din	41,843	Fair to Good	
7812	Enlisted Barracks W/O Din	41,843	Fair to Good	
7814	Enlisted Barracks W/O Din	41,843	Fair to Good	
7816	Enlisted Barracks W/O Din	41,843	Fair to Good	
7818	Enlisted Barracks W/O Din	41,843	Fair to Good	
7842	Enlisted Barracks W/AS	41,843	Good	
7844	Enlisted Barracks W/O Din	41,843	Good	1
7846	Enlisted Barracks W/AS	41,843	Good	
7848	Enlisted Barracks W/O Din	41,843	Fair	1
7850	Enlisted Barracks W/AS	41,843	Good	
7017	Bn HQ Bldg	2,604	Fair	
7215	Bn HQ Bldg	2,604	Fair	9
540	Officers Quarters Military	14,528	Good	9
541	Officers Quarters Military	18,083	Good	9
542	Officers Quarters Military	14,528	Good	9
723	Mnt Hangar Comb	21,640	Fair	
620	Officers Quarters Military	12,640	Good	1
621	Officers Quarters Trans.	10,723	Fair	2
27	Officers Quarters Military	38,146	Good	9
7036	Rgt Hqtr Building	10,010	Fair	9
5309	Guest House	23,784	Good	

Total SF to be added: 4,569,457

Note 1 Under renovation/design

Note 2 FY 95 OMA Design List

Note 3 Possible CERL Project

Note 4 1 Oct 94 convert 3 Co. admin to 1 Bn HQTR/HVAC changes to supply area

Note 5 AAFES building

Note 6 Single loop digital controllers installed

Note 7 If very tight humidity & temp constraints are not maintained in these buildings the contractor will shut computer equip. down and the Government is charged for all down time.

Note 8 I have been informed that the officers club has their own maintenance personnel and contractor.

Note 9 EMCS prepped

* = Typical Building

BUILDINGS THAT ARE NOW CONNECTED TO THE UEMCS

BUILDING	OCCUPANCY	SQUARE FT	EQUIP	QTY
184	Laundry Boiler Plant	1,959	FPU	1
203	Cavalry Museum	5,800	DSC REV C	1
205	Cavalry Museum	16,496	SLAVE	1
207	Cavalry Museum	8,278	DSC REV C	1
			SLAVE	2
211	Administrative	41,062	DSC REV C	1
253	Drug Abuse Center	11,122	DSC REV C	1
330	DEH Admin	14,913	FPU	1
364	UEMCS HQTRS	744	FPU	1
364	UEMCS HQTRS	744	DSC REV E	1
406*	CID BUILDING	10,390	DSC REV C	1
			SLAVE	1
615	IACH ENERGY PLT (FIBER OPT)	10,658	DSC REV E	2
615	IACH ENERGY PLT	10,658	DSC REV E	2
			SLAVE	5
650*	Cold Storage Facility	22,331	DSC REV C	1
652	Cold Storage Facility	8,167		
710	Tactical Equip Shop	2,173	DSC REV C	1
820	Tactical Equip Shop	20,564	DSC REV E	1
833	Aircraft Hanger	52,080	DSC REV C	1
			SLAVE	1
835	MAF Operations Building	19,470	DSC REV E	1
4010	Dental Clinic	15,587	DSC REV C	1
			SLAVE	1
5315	Morris Hill Chapel	19,748	DSC REV E	1
7210	CH Chiller Plant	4,320	DSC REV C	1
			SLAVE	1
8073	CH Energy Plant	4,070	FPU	7
8100	Consolidated Maintenance	224,927	FPU	6
8390	Tactical Equip Shop	24,755	DSC REV C	1
8300*	Veh Maint Shop Org	20,240	FPU	2
8320	Veh Maint Shop Org	20,240	FPU	2
8340	Veh Maint Shop Org	20,240	FPU	2
8360	Veh Maint Shop Org	39,428	FPU	3

Total area on existing EMCS = 651,164

Equipment Definitions;

FPU - Field Processing Unit

DSC - Digital System Controller (REV C - E)

Slave - Additional Field Interface Controller (FIC-101) without a processor (PCR-101) and a Control Display Board (CDB-101)

* = Typical Building

ANNEX B

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

- a. In title block clearly identify projects as "ECIP."
- b. Complete description of each item of work to be accomplished including quantity, square footage, etc.
- c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).
- d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.
 - (1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.
 - (2) Identify weather data source.
 - (3) Identify infiltration assumptions before and after improvements.
 - (4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.
- e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.
- f. Deleted

g. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

i. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

j. Deleted

k. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.

l. Any requirements required by ECIP guidance dated 10 January 1994 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.

m. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

ANNEX C

EXECUTIVE SUMMARY GUIDELINE

1. INTRODUCTION.
2. BUILDING DATA (types, number of similar buildings, sizes, etc.)
3. PRESENT ENERGY CONSUMPTION.
 - o Total Annual Energy Used.
 - o Source Energy Consumption.
 - Electricity - KWH, Dollars, BTU
 - Fuel Oil - GALS, Dollars, BTU
 - Natural Gas - THERMS, Dollars, BTU
 - Propane - GALS, Dollars, BTU
 - Other - QTY, Dollars, BTU
 - o Energy Consumption of the buildings in this study as compared to the basewide consumption.
4. HISTORICAL ENERGY CONSUMPTION.
5. REEVALUATED PROJECTS RESULTS.
6. ENERGY CONSERVATION ANALYSIS.
 - o ECOs Investigated.
 - o ECOs Recommended.
 - o ECOs Rejected. (Provide economics or reasons)
 - o ECIP Projects Developed. (Provide list)*
 - o Non-ECIP Projects Developed. (Provide list)*
 - o Operational or Policy Change Recommendations.

* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar

savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost.

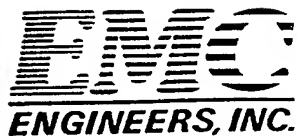
7. ENERGY AND COST SAVINGS.

- o Total Potential Energy and Cost Savings.
- o Percentage of Energy Conserved.
- o Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

8. ENERGY PLAN.

- o Project Breakouts with Total Cost and SIR.
- o Schedule of Energy Conservation Project Implementation





2750 South Wadsworth Blvd. • Suite C-200
Denver, Colorado 80227-3400
(303) 988-2951 • Fax: (303) 985-2527

24 August 1994

EMC #P13F-030

Mr. Bob Miller
ED-MF
US Army Corps of Engineers
Kansas City District
700 Federal Building
Kansas City, MO 64106-2896

Re: DACA 01-93-R-0148
Fort Riley HVAC Study

Dear Bob:

Enclosed is our fee proposal for the above referenced project. Our proposed fee is \$99,091. Dividing the total fee by the number of buildings results in a unit cost of about \$1400 per building. The fee is based on work defined by:

- Scope of Work dated 17 August 1994.

This fee is contingent on EMC performing the Ft. Riley UEMCS Study for which we have previously negotiated a fee.

The technical approach is divided into the following tasks with interface points with the UEMCS study noted:

1. A total of 70 buildings (approximately 30% of the buildings listed) will be evaluated for HVAC repair and replacement. The 70 buildings will be selected based on data collected during the UEMCS field survey in consultation with Fort Riley.
2. A detailed survey of each of the 70 buildings will be conducted by an HVAC design engineer for the purpose of collecting specific data regarding HVAC repair and replacement. Additional necessary plans will be pulled.
3. A written description of the HVAC system in each building will be prepared including an assessment of the existing condition and a tabulation of HVAC system parameters.
4. A cost estimate for restoring failed or failing HVAC systems to their intended operating condition will be prepared.

5. More efficient replacement HVAC systems will be identified and cost estimates for replacement of existing HVAC systems prepared.
6. Energy savings resulting from replacement of HVAC systems will be estimated through computer modeling of the existing and the proposed more efficient HVAC systems. The baseline models from the UEMCS study will be used as the baselines for the HVAC study. These baseline models will be modified to represent the proposed HVAC systems. Not all buildings will be modeled. Computer modeling will be limited to the approximately 20 modeled baselines of the UEMCS study. Results will be extrapolated to the remaining typical buildings. Only one replacement HVAC system will be evaluated per HVAC system.
7. A life cycle cost analysis will be performed for each building.
8. A written Interim Report will be prepared detailing the analysis and will be presented in an oral presentation at Fort Riley.
9. The Pre-Final Report will incorporate review comments from the Interim Report and will in addition contain Programming Documentation for repair or replacement projects selected by Fort Riley from the Interim Report. The Pre-Final Report will also include an oral presentation at Fort Riley.
10. The Final Report will incorporate all review comments from the Pre-Final Report.
11. The HVAC Study will be coordinated with the UEMCS Study such that UEMCS recommendations and costs will be applied to the most cost effective HVAC system. In other words, it will be assumed that the HVAC system will be repaired or replaced prior to installation of the UEMCS.

The following clarifications are made to the SOW:

1. Paragraph 2.4, the term "all ECOs" will apply only to HVAC system replacement. Only one replacement HVAC system will be evaluated for each existing HVAC system.
2. Paragraph 3.4, meetings at Fort Riley will be limited to those scheduled including kickoff meeting, exit interview, review conferences, and presentations. Telephone conferences will be scheduled whenever requested.

Mr. Bob Miller
US Army Corps of Engineers
Page 3 of 3

In developing the fee proposal, we allocated the following hours to each building:

Task	Manhours
Field Survey	2
Description/Deficiency Tabulation	1
HVAC System Data Tabulation	1
Repair Cost Estimate	3
Replacement System Description	1
Energy Savings Calculations	3
Replacement Cost Estimate	4
Life Cycle Cost Analysis	1
Total	16

We feel that 16 hours is the minimum time required per building to provide the required level of detail. The report will be organized by building and will provide sufficient detail for the designer to design an energy efficient system which can be installed for the indicated cost.

Please give me a call if you have any questions.

Sincerely,

E M C ENGINEERS, INC.


Dennis Jones

APPENDIX B
CONFIRMATION NOTICES AND
CORRESPONDENCE

CONFIRMATION NOTICE

Confirmation No. 2

EMC #1406-005

DATE: November 22, 1994

PROJECT: Feasibility Study for HVAC Upgrade
Fort Riley, Kansas

CONTRACT No.: DACA 01-93-D-0033

NOTES
PREPARED BY: Alan Niemeyer
E M C Engineers, Inc.

DATE OF
CONFERENCE: 8 November 1994

PLACE OF
CONFERENCE: Ft. Riley, Kansas

SUBJECT: Entrance Interview

ATTENDEES:	Steve Fief	PW HVAC	913-239-6315
	Keith Jevons	PW Design	913-239-2044
	Jayce Krause	PW HVAC	913-239-6315
	Larry Stillwagon	PW Energy	913-239-2371
	Ken Williams	PW Energy	913-239-8188
	Alan Niemeyer	EMC Engineers, Inc.	303-988-2951

The following is a summary of the items discussed, the comments and decisions made during the interview.

1. Alan Niemeyer opened the meeting and introductions of those attending were made.
2. Alan Niemeyer stated that the purpose of the HVAC Upgrade Study is to identify and evaluate repair and replacement of failed or failing HVAC equipment. A total of 70 buildings will be evaluated. These buildings were selected from building lists provided by Public Works Energy Branch and from EMC Engineers UMCS field survey information.
3. The replacement of existing HVAC systems with more efficient HVAC systems was discussed. Alan Niemeyer explained that Multizone AHUs and Dual Duct AHUs can be upgraded to VAV AHUs. Larry Stillwagon stated that the HVAC system upgrades should be basic HVAC system designs, and not complicated HVAC systems with highly specialized components. Also, Larry stated that VAV upgrade systems should be considered for those Multizone and Dual Duct AHUs where the cooling coils are the chilled water type coil. Multizone and Dual Duct AHUs with DX cooling coils should not be considered for a VAV upgrade system, as variable air volume across a DX coil can cause the coil to freeze up. A HVAC upgrade system that includes variable

CONFIRMATION NOTICE

22 November 1994

Page No. 2

temperature with variable air volume to the space and a constant air volume fan could be considered for AHUs with DX coils.

4. Alan Niemeyer indicated that some of the HVAC systems to be upgraded should be replaced with new HVAC systems of the same type and design. These HVAC systems include Single Zone AHUs, Heating and Ventilating Units, Fan Coil Units, and Residential Furnaces.
5. Other HVAC systems discussed included Unit Heaters, Window AC Units, and Perimeter Radiation. Alan Niemeyer indicated that Unit Heaters should be replaced with Infrared Radiant Heaters where possible. Larry Stillwagon explained that a 30% energy savings could be attained by using Infrared Radiant Heaters compared to using Unit Heaters. Alan Niemeyer stated that Window AC Units could be replaced by fan coil systems, packaged terminal air conditioning units (PTACs), or central air systems depending on the building layout and use. Air-to-Air Heat Pumps will not be considered for replacement of Window AC Units per discussion at the meeting. Alan Niemeyer explained that Perimeter Radiation could be upgraded with radiator control valves. Jayce Krause indicated that the condition of the radiation system piping should be considered, as some of the pipe is old, worn, and corroded. Installing new control valves on an old piping system could become very costly, as additional lengths of new pipe may be needed if existing pipe is too worn or corroded to connect up to.
6. HVAC system replacement was discussed for the "rolling pin" style barracks in the 7000 series area buildings. Existing fan coils in these barracks could be replaced with Multizone AHUs if proper clearance for installation of ductwork is available in the hallways.
7. HVAC system replacement was discussed for the barracks in the 8000 series area buildings. A design for replacement of existing fan coils is currently underway for some of these barracks. Keith Jevons stated that EMC Engineers should review the design for these replacement systems as a part of the HVAC Upgrade Study to advise if a more energy efficient system should be considered for the design.
8. The discussion of Unit Heaters for replacement with Infrared Radiant Heaters brought up the fact that the Motor Pool buildings (Buildings 7173, 7174, 7175, 7176, and 7178) were not included in either the HVAC Upgrade Study or the UMCS Study. These buildings are prime candidates for this type of HVAC system upgrade. Alan Niemeyer agreed to include buildings 7176 and 7178 in both studies. The list of buildings in the Scope of Work for the UMCS Study contained two buildings which were duplicated. Adding the two Motor Pool buildings will offset the duplication. The list of buildings for the HVAC Upgrade Study was adjusted to include the Motor Pool buildings, for a total of 70 buildings for evaluation.
9. Larry Stillwagon stated that the age of some of the buildings at Ft. Riley should be considered when evaluating some of the HVAC systems for upgrade. Buildings that


CONFIRMATION NOTICE

22 November 1994

Page No. 3

become 50 years or older are classified as historical. A building classified as historical is subject to many limitations and restrictions where renovation is concerned. Depending on the type of building, it may be more cost effective to demolish old buildings that are about to be classified as historical, rather than to renovate and upgrade the HVAC systems. These types of buildings will be coordinated with Larry Stillwagon during the course of the HVAC Upgrade Study.

10. Alan Niemeyer asked about the preference on installation of actuators for dampers and control valves. Larry Stillwagon explained that if a pneumatic system is currently in place in a building, and upgrading a HVAC system would not require installing extensive quantities of pneumatic lines, then pneumatic actuators would be appropriate to use. Electric and electronic actuators should be considered in the HVAC upgrade evaluations, as they may be more cost effective for installation and use than pneumatic actuators.
11. Larry Stillwagon requested that part of the HVAC Upgrade Study could evaluate energy savings for upgrading existing Domestic Hot Water (DHW) systems to more efficient systems. He suggested two typical cases, where large quantities of DHW are required in buildings. The two typical cases would include: 1) a HW boiler used for space heat that is also used for DHW heat; 2) a dedicated boiler used to generate DHW.
12. Two government funding programs were discussed. The two programs are the Energy Conservation Investment Program (ECIP) and the Federal Energy Management Program (FEMP). The ECIP program will be used for the HVAC system replacement evaluation and the FEMP will be used for the HVAC system repair evaluation. If the proposed HVAC system upgrades do not qualify for either program, they will be considered for implementation through Operations and Maintenance funds at Ft. Riley.
13. Larry Stillwagon indicated that maintenance cost savings used in life cycle cost analyses should be taken from ASHRAE standards.



Alan Niemeyer
Project Manager

Copies To: Tony Battaglia
Keith Jevons
Bob Miller
Larry Stillwagon
EMC file

If any portion of this confirmation notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions and conclusions, and status outlined in this confirmation notice is correct.



CONFIRMATION NOTICE

Confirmation No. 3

EMC #1406-005

DATE: November 22, 1994

PROJECT: Feasibility Study for HVAC Upgrade
Fort Riley, Kansas

CONTRACT No.: DACA 01-93-D-0033

NOTES
PREPARED BY: Alan Niemeyer
E M C Engineers, Inc.

DATE OF
CONFERENCE: 14 November 1994

PLACE OF
CONFERENCE: Ft. Riley, Kansas

SUBJECT: Exit Interview

ATTENDEES:	Larry Stillwagon	PW Energy	913-239-2371
	Alan Niemeyer	EMC Engineers, Inc.	303-988-2951

The following is a summary of the items discussed, the comments and decisions made during the interview.

1. General field survey observations for HVAC upgrade repair were presented by Alan Niemeyer. Some air handling units were observed to have the following components in disrepair:

- Damper actuators - missing or linkages disconnected
- Fan Motors - noisy bearings
- Fans - noisy bearings
- Control valves - actuators dismantled or leak; valve bodies extremely rusty.

Some pumps were observed to have the following components in disrepair:

- Motors - noisy bearings
- Pump seals - leaky

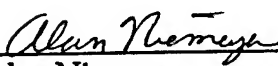
Chillers and boilers were generally observed to be in fair condition.

CONFIRMATION NOTICE

22 November 1994

Page No. 2

2. General field survey observations for HVAC upgrade replacement were presented by Alan Niemeyer. Some air handling units were observed to be damaged with holes cut into the fan and duct casings, and rust/corrosion penetrating through fan and duct casings. Some pumps were observed to be rusted and corroded. Some boilers were observed to be leaking from their interior, with rust and corrosion causing damage. The chillers were observed to be in fair condition, although some building managers interviewed said they had problems with their chillers shutting off during peak cooling load time periods. Age of the HVAC equipment was noted, to evaluate the remaining service life for equipment.
3. Alan Niemeyer indicated that building 8069 (swimming pool and gymnasium) had fair to good HVAC equipment and questioned why it was included on the HVAC upgrade list. Larry Stillwagon said this building has ventilation and humidity problems, and the HVAC systems should be evaluated for improving ventilation and reducing the humidity levels. Building 6940, also a swimming pool, should be evaluated for similar problems.
4. Alan Niemeyer requested a HVAC equipment listing from a computer data base at Ft. Riley, containing name plate data for the equipment. Larry Stillwagon said he would look into making the information available.
5. Alan Niemeyer requested a copy of the data transmission media (communication lines, telephone lines) drawings for the Main Post, Custer Hill, and Marshall Field areas. The drawings are not available in mylar or velum, so that blue print copies can be made. Larry Stillwagon said he would contact the DOIM office to make arrangements for the drawings to be copied.


Alan Niemeyer
Project Manager

Copies To: Tony Battaglia
Keith Jevons
Bob Miller
Larry Stillwagon
EMC file

If any portion of this confirmation notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions and conclusions, and status outlined in this confirmation notice is correct.



2750 South Wadsworth Blvd. • Suite C-200
Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 4

EMC #1406.005

DATE: 1 May 1995

PROJECT: Feasibility Study for HVAC Upgrade, Fort Riley, Kansas
CONTRACT NO.: DACA 01-93-D-0033

NOTES

PREPARED BY: Alan Niemeyer, E M C Engineers, Inc.

DATE OF
MEETING: 27 April 1995

PLACE OF
MEETING: Fort Riley, Kansas

SUBJECT: Interim Submittal Presentation and Review Conference

ATTENDEES:

David E. Werner	Kansas City District Corps of Engineers	(816) 426-2094
Robert S. Woodruff	Mobile District Corps of Engineers	(334) 694-4074
Keith R. Jevons	Public Works Design, Fort Riley	(913) 239-2044
Larry Stillwagon	Public Works Energy, Fort Riley	(913) 239-2371
Jack Olson	Public Works HVAC, Fort Riley	(913) 239-6315
Jayce Krause	Public Works HVAC, Fort Riley	(913) 239-6315
Dennis Jones	EMC Engineers, Inc.	(303) 988-2951
Alan Niemeyer	EMC Engineers, Inc.	(303) 988-2951

The presentation of the Interim Submittal for the Feasibility Study for HVAC Upgrade was given by Alan Niemeyer and Dennis Jones of EMC Engineers. The presentation included highlights from Sections 1 through 6, and a review of a typical proposed HVAC system replacement and typical HVAC system components for repair.

The Interim Submittal review comments were handed out to the meeting attendees.

Review comments were received for the Interim Submittal from the following organizations:

1 May 1995

Page 2 of 8

- Fort Riley Public Works Energy Branch
- HQ FORSCOM, Fort McPherson, GA
- USAED, Mobile, AL

The review comments were discussed and resolved during the course of the meeting. The responses to the review comments are as follows:

Comments from Larry Stillwagon, Fort Riley Public Works Energy Branch:

1. Comment #1. Annotation: CONCUR. Building 7612 currently has a dual temperature (DT) piping system. Heating and cooling coils, along with hot water and chilled water piping systems will be included in the proposed HVAC system description and cost estimate, instead of the DT piping system.
2. Comment #2. Annotation: CONCUR. Return air ductwork should be installed for the proposed VAV system in Building 7612, instead of a return air plenum. The main reason for not using a return air plenum is that existing electrical wiring and cable located within the proposed return air plenum is probably not rated for use inside an air plenum. (NFPA 90A 2-3.10.1 Plenums.)
3. Comment #3. Annotation: INFO. The VAV terminal units used in the cost estimate are constructed to meet proper sound level requirements in HVAC design (around 50 decibels). ASHRAE lists office air diffusers at sound levels around 50 decibels.
4. Comment #4. Annotation: CONCUR. The cost estimate will be changed to reflect 1/2 hour labor for demolition of each fan coil unit and 10 minutes labor for each 3-speed fan switch.
5. Comment #5. Annotation: CONCUR. I looked through our Scope of Work and could not find that asbestos removal was to be included in this study. The presence of suspect asbestos on the existing HVAC systems was noted as part of the Feasibility Study for Installation of UMCS.

The cost for asbestos removal will be added to the construction costs for the proposed HVAC system replacements that qualify for ECIP funding. Information from the UMCS Study field survey and Asbestos Assessment Study by Hall Kimbrell Environmental Services will be used to develop costs for asbestos removal.

6. Comment #6. Annotation: CONCUR. Page numbers for the appendix sections will be included in the Prefinal Submittal. The field survey notes in Appendix E will be subdivided with building group tabs, similar to Section 4 and Appendix D. Also, Tables 5-1, 5-2, and 6-1 will be sorted by tab number and building number.

1 May 1995

Page 3 of 8

7. Comment #7. Annotation: INFO. The electrical kW demand dollar savings were not calculated correctly on the Life Cycle Cost Analysis (LCCA) sheets. The electrical kW demand was estimated from information provided by Steve Pientka, Public Works, Fort Riley. We used an estimated electrical kW demand of \$4.20 per monthly kW. Because electrical kW is billed for using the highest peak kW reached during one month in a year, that electrical demand peak is billed for each month throughout the year. Our calculations omitted the total dollars saved for all the months in the year. We used \$4.20 per monthly kW instead of \$50.40 per annual kW (12 times the \$4.20 per kW).

Comments from Linda Eslinger, Fort Riley Public Works Energy Branch:

8. Comment #1. Annotation: CONCUR. The electrical energy unit cost of \$12.10 / Mbtu will be used on all LCCA calculation sheets. Also, we will use computer software, provided by Fort Riley Public Works Energy Branch, to calculate the electrical demand dollar savings for any summer peak electrical demand reductions.

Comments from Naresh K. Kapur, P.E., HQ FORSCOM, Fort McPherson, GA.:

9. Comment #1 Annotation: CONCUR. Comment is appreciated. Thank you.
10. Comment #2. Annotation: INFO. The construction costs were estimated using typical contractor markups of 16.8% for overhead and 10% for profit. This study assumes that a private contractor will be performing the construction work. At the study level or concept design level, a 20 percent contingency is typically used to cover unforeseen construction costs. The HVAC systems not qualifying for ECIP funding, may qualify for construction under O&M funding or another source of funding. The details of additional funding programs need to be discussed with Fort Riley Public Works personnel, especially who will be performing the construction work.
11. Comment #3. Annotation: INFO. This would not be necessary per discussions with HVAC Maintenance Shop and Public Works personnel.
12. Comment #4. Annotation: CONCUR. Overall energy savings, dollar savings, investment cost, simple payback, and SIR will be provided in Table ES-2 for the Prefinal Submittal.
13. Comment #5. Annotation: INFO. The three data sources used for selection of the 70 buildings are the information provided by Public Works Energy Branch,

1 May 1995

Page 4 of 8

Maintenance Shops, and the field survey from the UMCS Study. The condition of the existing HVAC systems, whether they were in good, fair, or poor condition, was the factor used in the selection.

The 70 buildings were selected from a list of 216 buildings. The 146 buildings, not included in this study, could also be evaluated as the 70 buildings in this study for an additional fee.

14. Comment #6. Annotation: INFO. The existing HVAC systems were evaluated for replacement with different types of HVAC systems that would meet the building design heating and cooling loads and operate more efficiently than existing HVAC systems. Changes in building use, from the original intended building use, were also included in the evaluation of HVAC system capacities for the proposed HVAC replacement systems.
15. Comment #7. Annotation: INFO. This would be good information for an overall basewide study, to compare these buildings with others. However, the scope of work for this energy study evaluates only a small percentage of buildings compared to the total number of buildings at Fort Riley. Additional information would be needed to state or make a comparison to other buildings at Fort Riley.
16. Comment #8. Annotation: DISAGREE. Table 2-1 is intended to provide general information about the building HVAC systems in the analysis. Section 4.0 provides an in-depth description and assessment of the HVAC systems on an individual building basis, including HVAC system sizes. It was agreed that the HVAC equipment types and sizes, presented in Section 4.0, are adequately represented.
17. Comment #9. Annotation: INFO. Visual observations were performed on cooling towers as part of the field survey. If rust, corrosion, or water scale build-up inside or on the cooling tower were visible, they were recorded on the field survey forms. The electric motors and tower fans were also visually observed.
18. Comment #10. Annotation: INFO. See Item No. 14, Comment #6.
19. Comment #11. Annotation: INFO. In Section 4, the Proposed HVAC System Replacement subsections are the ECO descriptions. Existing conditions of HVAC systems are described in the HVAC System Existing Conditions subsections. Per our Scope of Work, only one HVAC system replacement will be evaluated for an existing HVAC system. The source of energy and non-energy savings are discussed in the Method of Analysis subsections throughout Section 4. It was agreed that the format in Section 4.0 is adequate for describing the existing conditions and the proposed HVAC system replacements.

1 May 1995

Page 5 of 8

Generally, the existing ductwork will remain in place unless specifically mentioned that the existing ductwork would be replaced. When the construction costs for the proposed HVAC systems were estimated, new controls were included, as most of the existing controls are outdated and would not be appropriate for the proposed HVAC systems.

20. Comment #12. Annotation: INFO. In Section 4, under HVAC System Existing Conditions for each building, the year in which the building was built is provided. Most of the HVAC systems encountered were installed the same year the building was built. If a HVAC system was renovated, the year of renovation was included in the write-up. As far as information was available from design drawings and the field survey, sizes and capacities for HVAC equipment were provided in Section 4, HVAC System Existing Conditions write-ups.

Additional information on HVAC equipment in the 70 buildings will be provided by adding the field survey forms from the Feasibility Study for Installation of UMCS to Appendix E.

21. Comment #13. Annotation: CONCUR. The wording in this section will be changed to provide clarity.
22. Comment #14. Annotation: INFO. For Building 7404, the electrical demand savings were entered as zero. The estimated electrical demand dollar savings for the proposed HVAC system were included in the rate for electrical energy dollar savings.

The proposed HVAC system is the existing HVAC system that would be retrofitted, therefore nonrecurring costs were not included in the LCCA. The maintenance on the proposed HVAC system would not change significantly from the existing HVAC system, therefore maintenance savings were not included in the LCCA.

Building 7404 is currently being renovated, and will not be included in the recommended HVAC system replacements for ECIP funding.

23. Comment #15. Annotation: INFO. See Item No. 10, Comment #2. Also, Fort Riley does not have in-house or troop construction capability.
24. Comment #16. Annotation: INFO. A walk-through of selected buildings before the meeting could be arranged, for anyone who is interested.

Comments from Robert S. Woodruff, EN-DM, Mobile District, AL.:

25. Comment #1. Annotation: DISAGREE. From observations during the field survey for the heat pump systems in Buildings 200, 500, and 509, the water treatment for the closed-circuit cooling towers appears to be in-place and working well. Leaks and failure of the pipe fittings in the condenser water system appear to be related to poor installation.
26. Comment #2. Annotation: CONCUR. The majority of the building is a single story building. The north end of the building has two stories which contain first and second floor offices. Write-up will be changed to provide clarity.
27. Comment #3. Annotation: DISAGREE. See Item No. 25, Comment #1.
28. Comment #4. Annotation: INFO. Per the Scope of Work, the proposed HVAC replacement systems were evaluated for energy savings. Repair and replacement of poor HVAC components does not result in significant energy savings, and would not qualify for ECIP funding.
29. Comment #5. Annotation: INFO. Some of the fan motors on the single zone air handlers have already been replaced with high efficiency motors. The policy at Fort Riley is to replace failed standard efficiency motors with high efficiency motors. The administration office areas in similar Administration and Supply buildings at Fort Riley have fan coil units that cycle the fans on and off for cooling. Also, the infiltration of outside air into the office areas is significant due to several door openings per hour and infiltration through operable windows. With cycling of the fan and the infiltration through doors and windows, occupants should receive adequate amounts of outside air.
30. Comment #6. Annotation: INFO. The controls for the single zone air handling units should be evaluated as part of the UMCS Feasibility Study.
31. Comment #7. Annotation: CONCUR. The boiler listed in the table should read "Fair condition" instead of "Poor condition".
32. Comment #8. Annotation: CONCUR. The HVAC System Components for Repair table should read 1-1/2" CW control valve instead of a 1" CW control valve. Correction will be made to the repair cost.
33. Comment #9. Annotation: INFO. The air volume is regulated by the VAV terminal unit controllers which are connected to the damper actuators and the existing zone

dampers. There are no VAV terminal units. Heating is accomplished by HW perimeter radiation throughout the building.

34. Comment #10. Annotation: INFO. Paragraph 4.30.3 on page 4-71 explains why Building 7053 was not considered for a HVAC system replacement. The fan coil units in Building 7814 provide both heating and cooling. The fan coil units in Building 7053 provide cooling only, heating is provided by HW perimeter radiation. The HW perimeter radiation is in fair condition and provides an excellent way to heat the building. Because the fan coil units are cooling-only, they are used for only five months during the year. A cooling-only VAV system to replace the fan coil units would cost over \$200,000. The energy savings that would accrue from operation of the cooling-only VAV system vs the cooling-only fan coil units during a five month period would not be significant enough to pay for the installation of the cooling-only VAV system.
35. Comment #11. Annotation: CONCUR. The existing ductwork branches serve both the sanctuary and the basement areas. Both areas will have different heating and cooling loads, therefore VAV terminal units connected to the existing ductwork branches would not provide proper space temperature control. Additional ductwork and VAV terminal units will be included in the construction cost for the basement area, to make it a separate zone from the sanctuary.
36. Comment #12. Annotation: INFO. No. The heating profile of the kitchen space heating reflects the existing condition, and does not reflect the proposed heat recovery units. The kitchen space heating will be labeled as the existing condition.
37. Comment #13. Annotation: INFO. The title "Engineer's Opinion of Probable Cost" on the construction cost sheets is included as a legal protective measure and is recommended for use by our company insurance carrier.
38. Comment #14. Annotation: INFO. Maintenance does occur on the HVAC equipment at Fort Riley. Historical information on the hours required for maintenance and repair were not available. Typical maintenance and repair schedules for HVAC equipment types were assumed.
39. Comment #15. Annotation: INFO. Some of the field survey forms represent more than one piece of equipment. For instance, a building with several fan coil units has a field survey form that describes the general condition of all the fan coils, with specific notes for some of the fan coils. If a building has several air handlers or boilers that are identical and in the same condition, notes on a field survey form would describe the general condition of all, but would contain individual notes for a particular air handler or boiler describing a failed or failing condition.

1 May 1995


Page 8 of 8

For additional information for the 70 buildings in this study, the field survey forms from the Feasibility Study for Installation of UMCS will be included in Appendix E.

The project schedule was discussed. The date of 30 May 1995 was agreed upon for the next submittal, the Prefinal Submittal.

Packaging of the recommended HVAC system replacements for federal funding programs was discussed. Additional information is needed to determine which federal funding programs would be viable. EMC Engineers will provide a revised list of recommended HVAC system replacements to Larry Stillwagon. The recommended HVAC system replacements will reflect the changes discussed during this meeting, as stated in the review comments. This information will be provided to Larry Stillwagon by the 8th or 9th of May.

Larry Stillwagon will provide information concerning the packaging of the recommended HVAC system replacements for federal funding programs to EMC Engineers by May 15th.


Alan J. Niemeyer
Project Engineer, E M C Engineers, Inc.

Attachments: Written Government Comments

Action Required:

Recommended HVAC system replacements will be provided by EMC Engineers to Larry Stillwagon by the 8th or 9th of May;

Information will be provided by Larry Stillwagon for packaging the recommended HVAC system replacements for federal funding programs to EMC Engineers by May 15th.

cc:

David E. Werner
Keith R. Jevons

Robert S. Woodruff
Larry Stillwagon

Tony Battaglia
Dennis Jones

Naresh K. Kapur
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

FORT RILEY - PUBLIC WORKS
ENGINEERING REVIEW COMMENTS

TO: EMC ENGINEERS, INC.

Plans & Specifications / Design

PROJECT: HVAC UPGRADE

☐ Concept ☐ Final ☒ Other (INT REPORT)

STUDY

Designed by:

☒ A/E ☐ Dist ☐ DEH

SUSPENSE DATE:

Comments by:

Larry Stillwagon

Division:

PW-EE

Date:

25 MAR 1995

REFERENCE	ITEM	COMMENT	ACTION
-----------	------	---------	--------

BLDG 7612 VAV	1	The VAV AHUS should have heating and cooling coils. The current policy is to provide heating and cooling to the occupants. Having heating and cooling available will allow heating during the night and cooling during the day in the spring and fall.	
---------------	---	--	--

BLDG 7612 VAV	2	Contrary to what I told you 24 Mar 95, there is no requirement to provide a return duct. The Corps reviewed the Codes again and could not find that using the area above a drop ceiling for the return was a violation (sorry about that).	
---------------	---	--	--

BLDG 7612 VAV	3	Please provide additional information on the VAV units. Are there any problems with noise or control when using a damper in a duct like your cost estimate indicates?	
---------------	---	---	--

BLDG 7612 VAV	4	Your demolition costs seem too low. I don't think that we could get anyone to remove the 92 FC units for \$987. I also don't think that we will be able to get anything back for salvage on the pumps. I have the following comments on the demolition costs:	
---------------	---	---	--

FAN COIL DEMOLITION - If I assume that it takes 1/2 hour to remove each FCU, then the cost would be"

QTY	CREW	HOURS/UNIT	TOTAL
92	Q-5 *	.5	\$3,122

* \$67.86/hour from your labor cost

3-SPEED FAN SWITCH DEMOLITION - Using your labor cost for Q-5 of \$67.86 shouldn't this cost be:

QTY	CREW	HOURS/UNIT	TOTAL
92	Q-5	.2	\$1,249

FORT RILEY - PUBLIC WORKS
ENGINEERING REVIEW COMMENTS

TO: EMC ENGINEERS, INC.

Plans & Specifications / Design

PROJECT: HVAC UPGRADE

☐ Concept ☐ Final ☒ Other (INT REPORT)

STUDY

Designed by:

☒ A/E ☐ Dist ☐ DEH

SUSPENSE DATE:

Comments by:

Larry Stillwagon

Division:

PW-EE

Date:

25 MAR 1995

REFERENCE	ITEM	COMMENT	ACTION
-----------	------	---------	--------

BLDG 7612 VAV	5	The Corps is looking at a design to convert 7810 to VAV and they found Asbestos that had to be removed during the demolition (approx. \$70,000). I don't see any mention of Asbestos in your field survey notes. The detailed Scope of Work states that you should indicate any conditions/deficiencies, and I would think that the presences of Asbestos which would effect the price/payback should be noted.	
General	6	I found it difficult to find some things in your Report. You need to number all pages, as required in your Scope of Work. And when you have information on several different buildings in a section, they should be in numerical order or further subdivided with tabs (ex, Field Survey Notes in APPENDIX E).	
General	7	We looked at the electrical savings in the calculation of the costs and payback calculations for the Bldg 7612 project and didn't see what you were talking about when you said that you only included one months usage. Please provide addional information or an example of what you are talking about.	

PW, FORT RILEY, KS
ENERGY SECTION

FACSIMILE TRANSMISSION COVER SHEET

TO: NAME: Alan Niemeyer
LOCATION: EMC Engineers, Inc.
FAX NO: 303-985-2527
DATE: 4 April 95
NUMBER OF PAGES (INCLUDING COVER PAGE): 1
FROM: NAME: Linda Eslinger
PHONE NO: 913-239-2371
FAX NO: 913-239-6678
CONFIRMATION NO: 913-239-2371

MESSAGE:

Alan,

Referring to Section 2.3.1 Electricity of the interim report; based on previous projects and experience we want you to use the Electrical Energy Unit Cost of \$12.10/Mbtu for all Life Cycle Cost Analyses. If the project has a summer demand savings in electricity we estimate the savings to be \$42.00/kW per year. This figure is based on our own calculations using a demand limiting spreadsheet. Any demand during the winter peak can be ignored for demand savings.

We were recently informed that we need a DA Form 1391 for some projects we are submitting for FEMP funding including the UMCS. We will produce the form but it would be helpful for us if you could send us information so we can break down the cost by line items. Whatever you used to get your estimate would be great. It will be understood this is only a preliminary estimate. Time is not critical, but if we could get this in a week or so it would help us. Thank You.

Linda Eslinger

If you have any questions, please call.

PG 1 of 2

REVIEW COMMENTS FOR INTERIM SUBMITTAL :
FEASIBILITY STUDY FOR HVAC UPGRADE, FORT RILEY, KS

REVIEWER: NARESH K.KAPUR, P.E. DATED: 04 APR 95
ORGANIZATION: HQ FORSCOM
ADDRESS: ATTN: AFPI-ENO/KAPUR TEL: 404-669-5327, FAX -7751
BLDG. 200,
FORT MCPHERSON, GA 30330-6000

-
1. THE INTERIM REPORT IS WELL ORGANIZED. EMC EXPERIENCE SHOWS-CONGRATULATIONS.
 2. PG ES-2. LAST PARA 'THE HVAC SYSTEMS NOT QUALIFYING FOR ECIP FUNDING PROGRAM WERE NOT RECOMMENDED FOR REPLACEMENT'. UNDER WHAT CIRCUMSTANCES WILL THESE BE COST EFFECTIVE. FOR EXAMPLE SELF HELP OR INHOUSE ACCOMPLISHMENT WHICH WOULD REDUCE THE COST SIGNIFICANTLY. PL REFER TO CMT 15.
 3. TABLE ES-1 ON PG ES-3 IS VERY USEFUL FOR INSTALLATION TO FIX THE PROBLEM AREAS. IF POSSIBLE, MODIFY THE INFO IN THE TABLE SO THAT THE LOCATION OF EQUIPMENT CAN BE READILY IDENTIFIED.
 4. TABLE ES-2, PG ES-5. PROVIDE OVERALL FIGURES FOR ENERGY SAVINGS (MBTU/YR), ENERGY DOLLAR SAVING (\$/YR), TOTAL INVESTMENT (\$), SIMPLE PAYBACK (YRS), AND SIR.
 5. PARA 2.2 PG 2-1. ELABORATE THE FACTORS USED IN SELECTION OF 70 BUILDINGS OUT OF 216 BUILDINGS. WHAT ABOUT OTHER BUILDINGS? WHAT WOULD BE A REASONABLE WAY TO GENERATE ECOs FOR HVAC EQUIPMENT IN OTHER 156 BUILDINGS IF NEEDED?
 6. PG 2-3. PARA BELOW TABLE 2-1. IS THE ENERGY EFFICIENT EQUIPMENT TO REPLACE THE EXISTING ONE OF OPTIMUM CAPACITY RATHER THAN SAME SIZE AS EXISTING ONE? PL DISCUSS.
 7. TABLE 2-1. WHAT IS THE TOTAL AREA OF ALL THE SELECTED BUILDINGS? WHAT IS THIS AS A % OF TOTAL INSTALLATION AREA. THIS CAN BE GOOD INFO FOR EXECUTIVE SUMMARY.
 8. IF POSSIBLE, PL MODIFY TABLE 2-1 TO INCLUDE SIZE OF EQUIPMENT ALONG WITH TYPE OF EQUIPMENT.
 9. SECTION 3. WHAT KIND OF FIELD EVALUATION WAS DONE FOR THE COOLING TOWERS? USUALLY THESE POOR THINGS DO NOT GET MUCH ATTENTION UNTIL THEY STOP FUNCTIONING.
 10. PARA 3.3.2 PG 3-2. THE HVAC EQUIPMENT SHOULD BE CHECKED FOR OVER-SIZING AND THEN PICK UP THE ENERGY EFFICIENT EQUIPMENT TO REPLACE IT.
 11. GENERAL. IN SECTION 4, FOR EACH BUILDING, ESTABLISH A BRIEF ECO DESCRIPTION. IT SHOULD STATE CURRENT CONDITION, FUTURE CONDITION AFTER CONSIDERING VARIOUS OPTIONS, AND METHOD OF ACHIEVING THE CHANGE. MENTION SOURCE OF ENERGY SAVINGS AS WELL AS NON-ENERGY SAVINGS. REFER TO SKETCHES/PHOTOS, CATALOG CUT TYPE INFO AS APPROPRIATE. MENTIONING EFFICIENCIES AND SIZES OF EXISTING AND REPLACEMENT EQUIPMENT WOULD BE APPROPRIATE. MENTION IF THE EXISTING DUCT WORK (IF APPLICABLE) AND CONTROLS BE COMPATIBLE WITH REPLACEMENT EQUIPMENT. IF NOT, CONSIDER REPLACING THESE ITEMS ALSO TO ACHIEVE A BETTER OVERALL EFFICIENCY.

PG 2 of 2

REVIEW COMMENTS FOR INTERIM SUBMITTAL :
FEASIBILITY STUDY FOR HVAC UPGRADE, FORT RILEY, KS

REVIEWER: NARESH K.KAPUR, P.E. DATED: 04 APR 95
ORGANIZATION: HQ FORSCOM
ADDRESS: ATTN: AFPI-ENO/KAPUR TEL: 404-669-5327, FAX -7751
BLDG 200,
FORT MCPHERSON, GA 30330-6000

12. SECTION 4 GENERAL. UNDER 'HVAC SYSTEM EXISTING CONDITIONS' FOR VARIOUS BUILDINGS, PROVIDE AGE/SIZES/CAPACITIES OF VARIOUS UNITS AS FAR AS POSSIBLE.
13. SEC 4.6.3 PG 4-12. PL ELABORATE AS TO HOW THE EXISTING HVAC SYSTEM IS EFFICIENT. QUANTIFY EFFICIENCY IN SUPPORT THIS AND SIMILAR STATEMENTS FOR OTHER BUILDINGS.
14. PG 4-51. PL VERIFY THE INFORMATION IN THE TABLE, ESPECIALLY DEMAND SAVINGS AND MAINTENANCE SAVINGS. ARE THERE ANY OTHER NON ENERGY SAVINGS POSSIBLE? CHECK APPENDIX D FOR LCCA FOR THIS BUILDING.
15. APPENDIX D - TAB 1 FOR BLDG 222. COST ESTIMATES HAVE THE FOLLOWING ADD ONS: OVERHEAD-17%, PROFIT 10%, CONTINGENCY-20% FOR A TOTAL OF 54.17% (CUMULATIVE). THE TOTAL COST INCLUDING THESE ADDONS APPEARS AS CONST COST IN 1A OF LCCA SUMMARY. THEN SIOH(5.5%) AND DESIGN COST (6%) ARE ADDED. THE FINAL COST IN 1G OF THE LCCA SUMMARY IS 71.9% ABOVE THE BASIC COST. IS THIS REASONABLE? THIS COMMENT APPLIES TO OTHER BUILDINGS. PL DISCUSS IN DETAIL. IN VIEW OF THIS, WHICH OF THE NON-RECOMMENDED ECOS WILL QUALIFY FOR INHOUSE OR TROOP CONSTRUCTION ACCOMPLISHMENT (WITH VERY LOW OVERHEADS).
16. WE SUGGEST A WALK THRU SOME SELECTED BUILDINGS BEFORE THE MTG. EMC IS REQUESTED TO SHOW US SOME OF THE TYPICAL HVAC EQUIPMENT FOR WHICH REPAIR AND/OR REPLACEMENT IS RECOMMENDED. THIS WILL GIVE US A BETTER PERSPECTIVE AS TO WHAT IS BEING DISCUSSED AT THE MEETING.

REILEY1.DOC

Post-It™ brand fax transmittal memo 7671 16 April 95 # of pages 2

To: ALAN NIEMEYER	From: DAVID WERNER
Co: EMC ENGINEERS	En: CEMRK-EP-D1 Engineers
Dept:	Phone # 816 426 2997
Fax # 303 985-2527	Fax # 816 426 3690

OPTIONAL FORM 49 (2-89) As discussed. 4K

FAX TRANSMITTAL # of pages 2

To: Tony Battaglia	From: Nivesh Kapur
Mobile Dist CES	Phone # 404-669-5327
Fax # 404-669-2424	Fax # 7751
Tel # 404-669-2618	OPTIONAL SERVICES ADMINIST

NSN 7540-01-272-7365 5030-101

MOBILE DIST. OFFICE PROJECT REVIEW COMMENTS		DATE: 5 APR 95	PAGE 1 of 2
TO: Army Corps of Engineers Kansas City District		FROM: (Section): EN-DM (Reviewer): Robert S. Woodruff	
PROJECT: Feasibility Study for HVAC Upgrade LOCATION: FT. Riley, Kansas		Year:	Line Item No.:
Type of Action: Interim Report			

Item No.	Drawing No. Or Par. No.	COMMENTS	Review Action
1.	Para 4.1.4 Page 4-3	Based on the problems presented in the report a comprehensive water treatment program should be recommended.	
2.	Bldg. 222 Report P. 4-4	This paragraph states that building 222 is a single story building with first and second floor offices ?	
3.	Bldg. 500 Report P. 4-11	Many of the problems associated with this heat pump system could be eliminated with a good water treatment program.	
4.	Bldg. 5000 Report P. 4-17	The designer should consider the economics of replacing only the components in bad condition.	
5.	Bldg. 7602 Report P. 4-30	The second line of the top paragraph states that single zone air handlers will be replaced with more energy efficient single zone air handlers. Would it be more economical just to replace the existing blower motors with more efficient motors ? The new control sequence for the building calls for cycling the air handling units. Will an adequate amount of fresh air be supplied to the building occupants ? If cycling the new units is viable couldn't the existing units be cycled ?	
6.	Bldg. 7608 Report P. 4-32	Could the existing units be cycled for a low cost energy savings ?	
7.	Bldg. 7658 Report P. 4-35	The table shows the boiler (BLR-1) in poor condition whereas paragraph 4.16.2 states that the boiler is in fair condition.	
8.	Bldg. 402 Report P. 4-44	The table in the center of the page shows AHU-3 with a 1-1/2" control valve whereas the table at the shows this same unit with a 1" control valve.	
9.	Bldg. 7404 Report P. 4-50	The proposed system presented in paragraph 4.23.3 needs clarification. If the air volume is regulated by the dampers at the converted multizone air handling unit why have VAV boxes also regulate the air volume ? If the hot deck of the air handling unit is blanked-off how is heating accomplished ?	
10.	Bldg. 7814 Bldg. 7053 P. 4-65 & P. 4-71	Buildings 7814 and 7053 appear to be very similar. They both are about the same age with similar mechanical systems. Building 7814 is recommended for HVAC replacement while building 7053 is not. This doesn't make sense.	

MOBILE DIST. OFFICE PROJECT REVIEW COMMENTS		DATE: 5 APR 95	PAGE 2 of 2
TO: Army Corps of Engineers Kansas City District		FROM: (Section): EN-DM (Reviewer): Robert S. Woodruff	
PROJECT: Feasibility Study for HVAC Upgrade LOCATION: FT. Riley, Kansas		Year:	Line Item No.:
Type of Action: Interim Report			
Item No.	Drawing No. Or Par. No.	COMMENTS	Review Action
11.	Bldg. 3 P. 4-83	The zoning recommenced in the first paragraph on page 4-83 doesn't sound logical. How can a basement and ground level area be served by the same VAV box?	
12.	Bldg. 7245 P. 4-100	A large amount of the energy used, as illustrated in the chart at the top of page 4-100, is used for kitchen space heating. Does this profile take into account the recommended heat recovery make up air units?	
13.	Vol. 2 App. C	The cost sheets are labeled as "Opinion." These estimates are surely more than opinions.	
14.	Vol. 2 App. D	The Maintenance Costs Assumptions for the Air Handling Units appear to be high. At most army installations they don't even look at an air handler unless it totally fails.	
15.	General	Why do the building studies in volume 1 contain more data about the items of equipment in each building than is shown in the field survey data ?	

PW, FORT RILEY, KS
ENERGY SECTION

FACSIMILE TRANSMISSION COVER SHEET

TO: NAME: Alan Niemeyer
LOCATION: EMC Engineers, Inc.
FAX NO: 303-985-2527
DATE: 12 May 95
NUMBER OF PAGES (INCLUDING COVER PAGE): 1
FROM: NAME: Linda Eslinger
PHONE NO: 913-239-2371
FAX NO: 913-239-6678
CONFIRMATION NO: 913-239-2371

MESSAGE:

Alan,

Here is the list of how Larry would like the HVAC projects grouped:

- Group 1: 7665, 7670, 602 (Dental Clinics)
Group 2: 7245, 7606, 7654 (Dining Facilities)
Group all three projects for all three buildings together.
Group 3: 6940, 8069 (2 Pools)
Group 4: 7485 (Bowling Alley), 6620 (Activities Center - both projects)
Group 5: 7178 (Motor pool), 7806 (Bn Admin), 7086 (Chapel),
5000 (Fire Stn)

For the purposes of the EMCS Study, assume the projects for Groups 2 & 3 will be done by the time the EMCS is installed.

The rest of the projects can be finalized individually.

Linda Eslinger

BUILDINGS WITH SPECIAL CONSIDERATIONS
FOR HVAC REPAIR STUDY

Oct 5, 1994

NOTE 1: UNDER RENOVATION/DESIGN - ELIMINATE FROM LIST

223, 404, 610, 7844, 7848, 620 (BARRACKS) & 403 (ADMIN)

NOTE 2: FY 95 OMA DESIGN LIST - ELIMINATE FROM LIST

621, 409 (BARRACKS)

NOTE 3: CERL PROJECT - LEAVE ON LIST

7656 (TRAINING)

NOTE 4: 1 OCT 94 - CONVERT 3 CO ADMIN TO 1 BN HQTR/ HVAC
CHANGES TO SUPPLY AREA - ELIMINATE FROM LIST

8023 (ADMIN)

NOTE 5: AAFES BUILDING - LEAVE ON LIST

6914 (MAIN EXCHANGE)

NOTE 6: SINGLE LOOP DIGITAL CONTROLLERS INSTALLED - ELIMINATE
7604 ONLY

7656, 7604 (TRAINING) & 7108, 7109 (ADMIN)

NOTE 7: IF VERY TIGHT HUMIDITY & TEMPERATURE CONSTRAINTS ARE
NOT MAINTAINED IN THESE BUILDINGS, THE CONTRACTOR WILL
SHUT THE COMPUTER EQUIPMENT DOWN AND THE GOVERNMENT IS
CHARGED FOR ALL DOWN TIME - LOOK AT HVAC CLOSELY

722, 724 (BOTH FLIGHT SIMULATORS)

NOTE 8: EMCS PREPED BUILDINGS - FYI

LIST ENCLOSED

BUILDINGS TO INCLUDE IN HVAC EVALUATION

Oct 17, 1994

One of These	8021 8023 8057 8059	ADMIN & SUPPORT BLDG
	7243	ADMIN & SUPPORT BLDG
	7602	ADMIN & SUPPORT BLDG
	500	POST HQ BLDG
	200	ADMIN GEN PURPOSE
	509	ADMIN GEN PURPOSE
One of These	7404 7424	ENL BARRACKS W/O DIN
One of These	7814 7810	ENL BARRACKS W/O DIN
One of These	8002 8006 8012 8038 8042	ENL BARRACKS W/O DIN
One of These	8008 8014 8040 8048 8050 8054	ENL BARRACKS W/O DIN
One of These	7612 7614	ENL BARRACKS W/AS
	402	ENL BARRACKS W/AS
One or All of These	409 410 411	ENL BARRACKS W/AS
	227	ENL BARRACKS W/AS
	540	OFF QTRS MIL
	7806	BN HQ BLDG
	3	ST. MARY'S CHAPEL
	7245	ENL PERS DIN

BUILDINGS TO INCLUDE IN HVAC EVALUATION

Oct 17, 1994

One of
These

7606	ENL PERS DIN
7654	
741	MNT HANGAR COMB
727	MNT HANGAR COMB
7920	VEH MNT SHOP ORG
202	KING FIELD HOUSE - GYM
6914	MAIN POST EXCHANGE
8069	INDOOR POOL - LONG GYM
6940	INDOOR POOL - EYSTER
6620	CUSTER HILL ACTIVITIES CENTER



UTILITY CONTROL SYSTEM PROJECT ADDITIONAL BUILDINGS CONDITIONS OF CONTROLS AND HVAC SYSTEMS

BLDG	DESIGNATION	GROSS	UM	CONTROLS	CHILLER	Steam	BOILERS	Hot Water	AIR HANDLERS	FAN COILS
1	3 POST CHAPEL	8828	SF	FAIR	POOR	POOR			FAIR	
2	6 POST CHAPEL	8828	SF	FAIR	POOR		POOR			
3	27 OFF QTR MIL	38146	SF	GOOD			UNDER CONSTRUCTION			
4	29 RED CROSS BLDG	NOT GOVERN	SF	FAIR	WINDOW A/C					
5	184 LAUNDRY BOILER PLANT	1959	SF	FAIR						
6	200 ADMIN GEN PURP	60690	SF	FAIR TO GOOD	GOOD		GOOD			
7	202 PHYS FIT CENTER	51307	SF	FAIR	WINDOW A/Cs		GOOD			
8	203 CAVALRY MUSEUM	5800	SF	RENOVATION	FAIR	GOOD			GOOD	
9	205 CAVALRY MUSEUM	16496	SF	RENOVATION	FAIR	SUPPLIED BY 203				
10	206 THEATER W/O DRESS RM	10754	SF	POOR		POOR			POOR	
11	207 CAVALRY MUSEUM	8278	SF	RENOVATION	FAIR			GOOD	GOOD	
12	210 MIL PERS BLDG	58446	SF	POOR	GOOD		GOOD		GOOD	
13	211 ADMINISTRATIVE	41062	SF	FAIR				GOOD		
14	214 ENL BK W/AS	35821	SF	FAIR		FAIR			FAIR	
15	222 ADMIN GEN PURP	18854	SF	FAIR	GOOD			GOOD	FAIR	
16	223 ENL BKS W/DAS	47794	SF	POOR			POOR		FAIR	
17	227 ENL BKS W/AS	32303	SF	POOR			GOOD		FAIR	
18	253 DRUG ABUSE CENTER	11122	SF	FAIR	FAIR	BOILER BEING REPLACED				
19	301 FIN ADMIN BLDG	32947	SF	POOR	GOOD		GOOD		GOOD	
20	302 FIN ADMIN BLDG	16138	SF	POOR	GOOD		FAIR			
21	313 CIV PERS BLDG	6222	SF	FAIR	FAIR		FA Furnace (FAIR)			
22	319 GEN INST BLDG	9690	SF	POOR	GOOD		GOOD		GOOD	
23	330 DEN ADMIN	14913	SF	FAIR	FAIR	FORCED AIR FURNACE				
24	364 ENCS HQTRS.	744	SF	FAIR		FORCED AIR FURNACE				
25	402 ENL BKS W/AS	35718	SF	POOR	POOR		GOOD		FAIR	
26	403 ADMIN GEN (DESIGN PR	18151	SF	GOOD	WINDOW A/C	GOOD				
27	404 ENL BKS W/DAS	35718	SF	POOR	POOR		GOOD		FAIR	
28	405 ADMIN GEN PURP	10778	SF	POOR	GOOD		FAIR			GOOD
29	406 CID BLDG.	10390	SF	FAIR	GOOD	GOOD			GOOD	
30	409 ENL BKS W/AS	32883	SF	POOR	POOR		GOOD		FAIR	
31	410 ENL BKS W/AS	32883	SF	POOR	POOR		GOOD		FAIR	
32	411 ENL BKS W/AS	32883	SF	POOR	POOR		FAIR		FAIR	
33	446 OFF OPEN DINING	35068	SF	FAIR	GOOD			GOOD	GOOD	
34	500 POST HQ BLDG	65453	SF	FAIR TO GOOD	GOOD		GOOD			GOOD
35	509 ADMIN GEN PURPOSE	10108	SF	GOOD						
36	512 SEN ENL QTRS	13619	SF	POOR	GOOD		GOOD			GOOD
37	540 OFF QTRS MIL	14528	SF	GOOD	GOOD		GOOD			GOOD
38	541 OFF QTRS MIL	18083	SF	GOOD	GOOD		GOOD			GOOD
39	542 OFF QTRS MIL	14528	SF	GOOD	GOOD		GOOD			GOOD
40	602 DENTAL CLINIC	11557	SF	FAIR	GOOD	GOOD			GOOD	
41	610 ENL BKS W/AS	29004	SF	FAIR TO GOOD	WINDOW A/Cs		BOILER PLANT			
42	615 IACH ENERGY PLANT	10658	SF	FAIR						
43	620 OFF QTRS MIL	12640	SF	FAIR TO GOOD	WINDOW A/Cs		BOILER PLANT			
44	621 OFF QTRS TRANS	10723	SF	FAIR TO GOOD	WINDOW A/Cs		BOILER PLANT			
45	650 COLD STORAGE FACILIT	22331	SF	FAIR			FURNACE GOOD			
46	652 COLD STORAGE FACILIT	8167	SF	FAIR			RADIANT HEATER GOOD			
47	710 TACTICAL EQUIP SHOP	2173	SF	FAIR	GOOD			GOOD		
48	720 AF OPS BLDG	3705	SF	FAIR			FORCED AIR FURNACES GOOD			
49	722 FLIGHT SIMULATOR	7000	SF	POOR	GOOD		GOOD			
50	723 MHT HANGAR COMB	21640	SF	FAIR		FAIR			POOR	
51	724 FLT SIM BLDG	13188	SF	GOOD	FAIR		FAIR			

? - A/C & Steam provided by 8073 Boiler Plant

* A/C supplied by Chiller Plant 7210

UCS ADDITIONAL BUILDINGS CONDITION OF CONTROLS AND HVAC SYSTEMS

#	BLDG	DESIGNATION	GROSS	UH	CONTROLS	CHILLER	Steam-BOILERS-Hot Wtr	AIR HANDLERS	FAN COILS
52	727	MNT HANGER COMB	36172	SF	GOOD	WINDOW A/Cs	FAIR		
53	741	MAINT HANGAR COMB	38898	SF	FAIR		GOOD		POOR
54	751	AC PTS & TOE ST	9834	SF	FAIR		GOOD		
55	760	BN HQTR BLDG	7364	SF	FAIR		BOILER BEING REPLACED		
55	802	BN ADMIN & CLRM	12526	SF	GOOD	SUPPLIED BY 806			GOOD
57	804	RGT HQ BLDG	10241	SF	GOOD	SUPPLIED BY 806			GOOD
58	806	COMB AC-HTG PLANT	1000	SF	GOOD	GOOD		GOOD	
59	806	BN ADMIN & CLRM	12526	SF	GOOD	SUPPLIED BY 806			GOOD
60	810	ADM & SUP BLDG	15152	SF	GOOD	GOOD		GOOD	GOOD
61	812	ADM & SUP BLDG	23559	SF	GOOD	GOOD		GOOD	GOOD
62	814	MEDICAL FACILITY	NOT LISTED	SF	NEW	NEW		NEW	
63	817	MNT HANGAR AVUM	40061	SF	FAIR			GOOD	
64	820	VEH MNT SH ORG	20564	SF	GOOD	GOOD		GOOD	GOOD
65	820	TACTICAL EQUIP SHOP	20564	SF	FAIR	FAIR		GOOD	
65	833	AIRCRAFT HANGER	52080	SF	FAIR	GOOD		GOOD	GOOD
67	835	MAF OPERATIONS BLDG.	19470	SF	FAIR	SUPPLIED FROM 833			GOOD
68	840	VEH MNT SH ORG	9152	SF	GOOD	GOOD		GOOD	GOOD
69	853	MNT HANGAR AVUM	48112	SF	FAIR			GOOD	
70	1476	AR VEH MNT SHOP	21667	SF	FAIR	GOOD		GPPD	GOOD
71	1950	SALV & SUPP PROP	42480	SF	GOOD		FORCED AIR FURNACES	GOOD	
72	1980	PHYS FITNESS CENTER	24968	SF	FAIR TO GOOD	GOOD		GOOD	
73	4010	DENTAL CLINIC	15587	SF	FAIR	GOOD			GOOD
74	5000	FIRE STATION	8400	SF	FAIR	POOR		POOR	FAIR
75	5302	POST OFFICE	12240	SF	FAIR	GOOD		GOOD	GOOD
76	5309	GUEST HOUSE	23784	SF	FAIR	GOOD		GOOD	GOOD
77	5315	MORRIS HILL CHAPEL	19748	SF	FAIR	GOOD			FAIR
78	5800	YOUTH CENTER	NO LISTING	SF	GOOD	GOOD		GOOD	GOOD
79	6520	COMMUN ACT CTR	31740	SF	FAIR	FAIR		GOOD	POOR
80	6910	EXC SP ST FAC	2525	SF	POOR	GOOD	FORCED AIR FURNACES	GOOD	
81	6914	EXC MAIN RETL	63830	SF	FAIR	POOR		FAIR	FAIR
82	6918	SKILL DEV CEN	11507	SF	GOOD	GOOD			
83	6940	INDOOR SWIMMING POOL	23347	SF	POOR			GOOD	FAIR
84	7004	ENL BKS W/DAS	39675	SF	FAIR	GOOD *		FAIR	POOR
85	7007	ENL BKS W/DAS	39675	SF	FAIR	GOOD *		FAIR	POOR
86	7010	ENL BKS W/DAS	39675	SF	FAIR	GOOD *		FAIR	POOR
87	7013	ENL BKS W/DAS	39675	SF	FAIR	GOOD *		FAIR	POOR
88	7017	BN HQ BLDG	2604	SF	FAIR	GOOD	FORCED AIR FURNACES	GOOD	
89	7024	GYMNASIUM	20619	SF	FAIR			GOOD	POOR
90	7028	BN CLASSROOMS	3733	SF	FAIR	*		POOR	
91	7031	BN HQ BLDG	3733	SF	FAIR	*		GOOD	FAIR
92	7033	BN HQTR BLDG	4083	SF	FAIR	*	FAIR		FAIR
93	7034	CLINIC W/O BEDS	3842	SF	FAIR	*	GOOD		GOOD
94	7036	RGT HQTR BLDG	10010	SF	FAIR	*		FAIR	GOOD
95	7044	ENL BK W/O DIN	52027	SF	FAIR	*	POOR		GOOD
96	7046	BN CLASSROOMS	3733	SF	FAIR	*		GOOD	GOOD
97	7047	BN HQ BLDG	3733	SF	FAIR	*		GOOD	GOOD
98	7048	BN HQ BLDG	2604	SF	FAIR	*		GOOD	GOOD
99	7050	ENL BK W/AS	39675	SF	FAIR	*		GOOD	POOR
00	7053	ENL BK W/AS	39675	SF	FAIR	*		FAIR	POOR
01	7055	BN HQ BLDG	2604	SF	FAIR	*		FAIR	GOOD
02	7085	UNIT CHAPEL	8696	SF	FAIR	GOOD		GOOD	FAIR
03	7108	BN ADMIN & CLRM	12527	SF	GOOD	GOOD		GOOD	GOOD
04	7109	BN ADMIN & CLRM	13535	SF	GOOD	GOOD		GOOD	GOOD
05	7210	CH CHILLER PLANT	4320	SF	FAIR	GOOD			GOOD

* - A/C & Steam provided by 6073 Boiler Plant

* A/C supplied by Chiller Plant 7210

UCS ADDITIONAL BUILDINGS CONDITION OF CONTROLS AND HVAC SYSTEMS

#	BLDG	DESIGNATION	GROSS	UM	CONTROLS	CHILLER	Steam-BOILERS-Hot Wtr	AIR HANDLERS	FAN COILS
106	7212	CO HQ BLDG	19320	SF	GOOD	GOOD	GOOD	GOOD	GOOD
107	7215	BN HQ BLDG	2604	SF	FAIR	GOOD		FAIR	POOR
108	7218	BN HQTR BLDG	12625	SF	GOOD	GOOD		GOOD	GOOD
109	7220	CO HQ BLDG	18870	SF	GOOD	GOOD	GOOD	GOOD	GOOD
110	7224	ENL BK W/AS	52027	SF	FAIR	*	POOR		GOOD
111	7227	ENL BK W/DAS	52027	SF	FAIR	*	POOR		GOOD
112	7230	ENL BK W/AS	52027	SF	FAIR	*	POOR		GOOD
113	7233	ENL BK W/AS	39333	SF	FAIR	*	POOR		GOOD
114	7243	ADMIN & SUP BLDG	17829	SF	FAIR	*		GOOD	GOOD
115	7245	ENL PERS DIKE	13938	SF	FAIR	GOOD *	GOOD		POOR
116	7253	FIN ADMIN BLDG	52400	SF	GOOD	WINDOW POOR	FAIR		POOR
117	7264	LIBRARY	31240	SF	GOOD	FAIR	FAIR		FAIR
118	7270	BN HQ BLDG	6130	SF	FAIR TO GOOD	GOOD	FAIR		GOOD
119	7285	CLOTHING SALES	17042	SF	FAIR	FAIR		FAIR	FAIR
120	7305	APP INSTR BLDG	9872	SF	FAIR	FAIR	FORCED AIR FURNACE		
121	7350	VEH MNT SH ORG	21345	SF	FAIR		CO-RAY VAC	FURNACES	FORCED AIR
122	7404	ENL BK W/O DIN	50967	SF	FAIR	GOOD *	GOOD		FAIR
123	7410	BN ADMIN & CLRM	12599	SF	FAIR	FAIR		GOOD	GOOD
124	7424	ENL BK W/O DIN	50967	SF	FAIR	GOOD *	GOOD		FAIR
125	7432	ADM & SUP BLDG	23016	SF	GOOD	GOOD	GOOD		GOOD
126	7450	RGT HQ BLDG	9850	SF	FAIR	FAIR		FAIR	FAIR
127	7485	BOOKING ALLEY	36966	SF	VERY POOR	FAIR		GOOD	FAIR
128	7500	VEH MNT SH ORG	22325	SF	GOOD		CO-RAY VAC	FURNACES	FORCED AIR
129	7520	VEH MN SH ORG	27112	SF	GOOD		CO-RAY VAC	FURNACES	FORCED AIR
130	7602	ADMIN & SUP	13520	SF	FAIR	FAIR		FAIR	
131	7604	GEN INSTR BLDG	1346	SF	GOOD		BLDG BEING RENOVATED		
132	7606	ENL PERS DIKE	13493	SF	FAIR	FAIR	POOR		POOR
133	7608	ADMIN & SUP	13520	SF	FAIR	FAIR	FAIR		FAIR
134	7610	ENL BK W/AS	41892	SF	FAIR TO GOOD	FAIR	POOR	FAIR	POOR
135	7612	ENL BK W/AS	41892	SF	FAIR TO GOOD	FAIR	POOR	FAIR	POOR
136	7614	ENL BK W/AS	41892	SF	FAIR TO GOOD	FAIR	POOR	FAIR	POOR
137	7616	ENL BK W/AS	41892	SF	FAIR TO GOOD	FAIR	POOR	FAIR	POOR
138	7618	ENL BK W/O DIN	41892	SF	FAIR TO GOOD	FAIR	POOR	FAIR	FAIR
139	7620	BN ADMIN & CLRM	6340	SF	FAIR	FAIR		FAIR	FAIR
140	7622	BN ADMIN & CLRM	12380	SF	FAIR	FAIR		FAIR	FAIR
141	7624	BN ADMIN & CLRM	6158	SF	FAIR	FAIR		FAIR	FAIR
142	7626	CLINIC W/O BEDS	3504	SF	GOOD	FAIR		POOR	POOR
143	7630	BN ADMIN & CLRM	6158	SF	FAIR	FAIR		FAIR	FAIR
144	7632	GYMNASIUM	20694	SF	FAIR		FAIR		POOR
145	7636	RGT HQ BLDG	9850	SF	FAIR TO GOOD	FAIR		FAIR	FAIR
146	7638	BN ADMIN & CLRM	6158	SF	FAIR	FAIR		FAIR	FAIR
147	7640	EXCHANGE BRANCH	4876	SF	POOR	FAIR		FAIR	POOR
148	7642	ENL BK W/O DIN	41892	SF	GOOD	FAIR	FAIR	FAIR	FAIR
149	7644	ENL BK W/O DIN	41892	SF	FAIR	FAIR	FAIR	FAIR	FAIR
150	7646	ENL BK W/O DIN	41892	SF	GOOD	FAIR	FAIR	FAIR	FAIR
151	7648	ENL BK W/O DIN	41892	SF	FAIR TO GOOD	FAIR	FAIR	FAIR	FAIR
152	7650	ENL BK W/O DIN	41892	SF	GOOD	FAIR	FAIR	FAIR	FAIR
153	7652	ADM & SUP BLDG	13520	SF	GOOD	FAIR		POOR	POOR
154	7654	ENL PERS DIKE	13493	SF	FAIR	FAIR	POOR		POOR
155	7654	ENL PERS DIKE	13493	SF	FAIR	FAIR		POOR	POOR
156	7656	GEN INST BLDG	13493	SF	GOOD	FAIR		FAIR	GOOD
157	7658	ADM & SUP BLDG	13520	SF	GOOD	FAIR		POOR	POOR
158	7665	DENTAL CLINIC	11076	SF	FAIR	FAIR	FAIR		GOOD
159	7670	DENTAL CLINIC	14960	SF	FAIR	FAIR	GOOD		GOOD

EP - A/C & Steam provided by 2073 Boiler Plant

* A/C supplied by Chiller Plant 7210

JCS ADDITIONAL BUILDINGS CONDITION OF CONTROLS AND HVAC SYSTEMS

#	BLDG	DESIGNATION	GROSS	UM	CONTROLS	CHILLER	Steam-BOILERS-Hot Wtr	AIR HANDLERS	FAN COILS
150	7120	VEH MNT SH ORG	22325	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR	
151	7139	TGT MOV SH BD	4074	SF	POOR	POOR		POOR POOR	
152	7140	VEH MNT SH ORG	22325	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR	
153	7150	VEH MN SH ORG	17163	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR	
154	7150	VEH MN SH ORG	17163	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR	
155	7392	ADMIN & SUP	13280	SF	FAIR	FAIR		GOOD	FAIR
156	7804	ENL PERS DINE	13493	SF	FAIR	POOR	GOOD	POOR	
157	7806	BN HQ BLDG	13493	SF	FAIR TO GOOD	GOOD		GOOD	POOR
158	7808	ADMIN & SUP	13280	SF	FAIR	FAIR		FAIR	FAIR
159	7810	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD	POOR
160	7812	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD	POOR
161	7814	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD	POOR
162	7816	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD	POOR
163	7818	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD	GOOD
164	7820	BN ADMIN & CLRM	5673	SF	FAIR	FAIR		FAIR	FAIR
165	7824	BN ADMIN & CLRM	12246	SF	FAIR	FAIR		FAIR	FAIR
166	7826	CLINIC W/O BED	3841	SF	GOOD	FAIR		GOOD	FAIR
167	7832	GYMNASIUM	20634	SF	FAIR			GOOD	POOR
168	7834	RGT HQ BLDG	9904	SF	GOOD	POOR		GOOD	FAIR
169	7836	BN ADMIN & CLRM	12246	SF	FAIR TO GOOD	GOOD		FAIR	GOOD
170	7840	EXCHANGE BRANCH	4798	SF	GOOD	GOOD		FAIR	FAIR
171	7842	ENL BK W/AS	41843	SF	GOOD	GOOD	POOR	GOOD	GOOD
172	7844	ENL BK W/O DIN	41843	SF	GOOD	GOOD	GOOD	GOOD	POOR
173	7846	ENL BK W/AS	41843	SF	GOOD	GOOD	GOOD	GOOD	GOOD
174	7848	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	POOR	POOR
175	7850	ENL BK W/AS	41843	SF	GOOD	GOOD	POOR	GOOD	GOOD
176	7852	ADMIN & SUP	13260	SF	FAIR	FAIR		GOOD	FAIR
177	7854	BN HQ BLDG	13493	SF	FAIR	GOOD	GOOD	POOR	POOR
178	7856	ENL PERS DINE	13493	SF	FAIR	FAIR	GOOD	POOR	FAIR
179	7858	ADMIN & SUP	13280	SF	FAIR	FAIR		GOOD	FAIR
180	7865	UNIT CHAPEL	8718	SF	FAIR	POOR		FAIR	FAIR
181	7866	THTR W/DRESS RM	11038	SF	FAIR	POOR	FAIR	POOR	POOR
182	7900	VEH MN SH ORG	20943	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR	
183	7920	VEH MNT SH DS	124553	SF	FAIR		INFERRED HEATERS, FORCED AIR	FURNACES	
184	7940	VEH MN SH ORG	22405	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR	
185	7950	VEH MNT SH ORG	20245	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR	
186	8002	ENL BK W/O DIN	22700	SF	POOR	BP	BP	FAIR-GOOD	FAIR
187	8006	ENL BK W/O DIN	22700	SF	POOR	BP	BP	FAIR-GOOD	FAIR
188	8008	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD	FAIR
189	8010	DET DAY ROOM	2100	SF	POOR	BP	BP	N/A	FAIR
190	8012	ENL BK W/O DIN	22700	SF	POOR	BP	BP	GOOD	FAIR
191	8014	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD	FAIR
192	8018	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD	FAIR
193	8020	DET DAY ROOM	2100	SF	POOR	BP	BP	N/A	FAIR
194	8021	ADM & SUP BLDG	23676	SF	POOR	BP	BP	GOOD	FAIR
195	8023	ADM & SUP BLDG	23676	SF	POOR	BP	BP	GOOD	FAIR
196	8025	BN ADMIN & CLRM	12000	SF	POOR	BP	BP	FAIR-GOOD	GOOD
197	8037	BN ADMIN & CLRM	12208	SF	POOR	BP	BP	FAIR-GOOD	GOOD
198	8038	ENL BK W/O DIN	22700	SF	POOR	BP	BP	FAIR-GOOD	FAIR
199	8040	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD	FAIR
200	8042	ENL BK W/O DIN	22700	SF	POOR	BP	BP	FAIR-GOOD	FAIR
201	8044	APPL INST BLDG	2470	SF	POOR	GOOD		GOOD	
202	8046	DET DAY ROOM	2100	SF	POOR	BP	BP	FAIR-GOOD	GOOD
203	8048	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD	FAIR

32 - L/C & Steam provided by 8073 Boiler Plant

* A/C supplied by Chiller Plant 7210

UCS ADDITIONAL BUILDINGS CONDITION OF CONTROLS AND HVAC SYSTEMS

#	BLDG	DESIGNATION	GROSS	UM	CONTROLS	CHILLER	Steam-BOILERS-Hot Wtr	AIR HANDLERS	FAN COILS
	8050	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD	FAIR
211	8052	SEN ENL QTRS	22700	SF	POOR	BP	BP	FAIR-GOOD	FAIR
216	8054	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD	FAIR
217	8056	DET DAY ROOM	2100	SF	POOR	BP	BP	GOOD	GOOD
218	8057	ADM & SUP BLDG	23676	SF	POOR	BP	BP	GOOD	FAIR
219	8059	ADM & SUP BLDG	23676	SF	POOR	BP	BP	NONE	FAIR
220	8063	ENL PERS DINE	18313	SF	POOR	BP	BP	GOOD	GOOD
221	8065	CLINIC W/O BEDS	3848	SF	POOR	BP	BP	GOOD	GOOD
222	8067	EXCHANGE BRANCH	4850	SF	POOR	BP	BP	POOR	FAIR
223	8069	IN SW POOL/GYM	25620	SF	FAIR				
224	8071	RGT HQ BLDG	9963	SF	POOR	BP	BP	NONE	GOOD
225	8073	CH ENERGY PLANT	4070	SF	FAIR				
226	8100	CONSOLIDATED MAINTEN	224927	SF	FAIR	FAIR		FAIR	FAIR
227	8300	VEH MNT SH ORG	20240	SF	FAIR		CO-RAY VAC	FURNACES FORCED AIR	
228	8320	VEH MNT SH ORG	20240	SF	FAIR		CO-RAY VAC	FURNACES FORCED AIR	
229	8330	VEH MNT SH ORG	39256	SF	FAIR	FAIR	GOOD	GOOD	
230	8340	VEH MNT SH ORG	20240	SF	FAIR		CO-RAY VAC	FURNACES FORCED AIR	
231	8350	VEH MNT SH ORG	20428	SF	FAIR		CO-RAY VAC	FURNACES FORCED AIR	
232	8370	VEH MNT SH ORG	25875	SF	FAIR		FORCED AIR FURNACES		
233	8380	VEH MNT SH ORG	NO LISTING	SF	GOOD				
234	8390	TACTICAL EQUIP SHOP	24755	SF	FAIR	FAIR		FAIR	GOOD
235	8410	VEH MNT SH ORG	73233	SF	FAIR		PERFECTION HEAT, FURNACE	FORCED AIR	

BP - A/C & Steam provided by 8073 Boiler Plant

* A/C supplied by Chiller Plant 7210



2750 South Wadsworth Blvd. • Suite C-200
Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 5

EMC #1406.005

DATE: 1 August 1995

PROJECT: Feasibility Study for HVAC Upgrade, Fort Riley, Kansas
CONTRACT NO.: DACA 01-93-D-0033

NOTES

PREPARED BY: Alan Niemeyer, E M C Engineers, Inc.

DATE REVIEW

COMMENTS

RECEIVED: 24 July 1995

DATE OF

TELEPHONE

CONVERSATION: 1 August 1995

SUBJECT: Prefinal Submittal Review Comments

REVIEW COMMENTS RECEIVED FROM:

Robert S. Woodruff Mobile District Corps of Engineers (334) 694-4074

No presentation and review conference were given for the Prefinal Submittal of Feasibility Study for HVAC Upgrade. The presentation and review conference were not given because of the small number of review comments received for this study.

The review comments received were discussed and resolved via a telephone call with Robert S. Woodruff. The responses to the review comments are as follows:

1. Comment #1. Annotation: CONCUR. The table ES-2 in the Executive Summary will be edited to include the totals for energy saved and energy dollars saved. The table 6-2 in Section 6, similar to table ES-2, will also be edited to include this information.
2. Comment #2. Annotation: DISAGREE. The condition of the HVAC equipment is contained on the HVAC Upgrade Observation survey forms in Vol. II FIELD SURVEY FORMS. These survey forms list the components on each of the HVAC

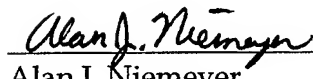
Confirmation Notice No. 5

1 August 1995

Page 2 of 2

systems. For each of these components, the condition is designated either OK or a comment was written describing the damage or the repair and replacement required.

The overall condition of each of the HVAC systems was summed up and reported in Vol. I, Section 4. The overall condition for each of the HVAC systems was designated as either GOOD, FAIR, or POOR. If the condition of a HVAC system was POOR, the components which were damaged or in need of repair or replacement were reported.



Alan J. Niemeyer

Project Engineer, E M C Engineers, Inc.

Attachments: Reviewer Comments

Action Required: None

cc:

David E. Werner

Robert S. Woodruff

Tony Battaglia

Naresh K. Kapur

Keith R. Jevons

Larry Stillwagon

Dennis Jones

File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

MOBILE DIST. OFFICE PROJECT REVIEW COMMENTS		DATE: 12 JUN 95	PAGE 1 of 1
TO: Army Corps of Engineers Kansas City District		FROM: (Section): EN-DM (Reviewer): Robert S. Woodruff	
PROJECT: Feasibility Study for HVAC Upgrade LOCATION: FT. Riley, Kansas		Year:	Line Item No.:
Type of Action: Prefinal Report			

Item No.	Drawing No. Or Par. No.	COMMENTS	Review Action
1.	Vol I. Exec. Summary	The table listing the recommended HVAC replacements should have the dollars saved and METU saved columns totaled. This enables readers to see the total results of this study.	
2.	Vol II. General	The condition of the various pieces of equipment is not contained in the field notes. This should be included as part of these notes.	

APPENDIX C

**COST ESTIMATE FOR HVAC SYSTEM
COMPONENTS FOR REPAIR**

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		DATE PREPARED		9-May-95		SHEET		1 OF 8	
		ESTIMATOR		T. Poeling		CHECKED BY		A. Niemeyer	
		CHECKED BY		A. Niemeyer					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 222 REPAIR							
2	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	\$190.89	\$191	1-STPI	1.5	\$32
3									\$223
4		BUILDING 302 REPAIR							
5	FANBRG	FAN BEARING (INCL. DEMO)	EA.	1	\$15.99	\$16	Q-9	4	\$75
6									\$91
7		BUILDING 313 REPAIR							
8	COIL	CONDENSER COIL (PLUS COVER)	EA	1	\$545.06	\$545	Q-5	13	\$252
9									\$797
10		BUILDING 8056 REPAIR							
11	PMP3/4HP	PUMP, 3/4 HP, (INCL. DEMO)	EA.	1	\$620.16	\$620	Q-1	6.4	\$124
12									\$744
13		BUILDING 7636 REPAIR							
14	CV2.5	CONTROL VALVE 2-1/2" (INCL. DEMO)	EA.	1	\$935.09	\$935	1-PLUM	5.334	\$115
15									\$1,050
16		BUILDING 7612 REPAIR							
17	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	1	\$14.54	\$15	Q-1	10	\$194
18									\$208
19		BUILDING 7614 REPAIR							
20	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	3	\$14.54	\$44	Q-1	10	\$582
21									\$625
22		BUILDING 7810 REPAIR							
23	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	2	\$14.54	\$29	Q-1	10	\$388
24									\$417
25		BUILDING 7814 REPAIR							
26	PMP2HP	PUMP, 2 HP (INCL. DEMO)	EA	1	\$867.26	\$867	Q-1	7.4	\$143
27	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	1	\$14.54	\$15	Q-1	10	\$194
28		TOTAL - BUILDING 7814							\$1,011
29									\$208
30		BUILDING 8002 REPAIR							\$1,219
31	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	\$145.35	\$1,744	1-PLUM	0.546	\$141
32	3SWTCH	3-SPEED FAN SWITCH	EA.	12	\$14.54	\$174	1-ELEC	0.667	\$168
33		TOTAL - BUILDING 8002							\$1,885
34									\$342
35									\$2,227

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT				Fort Riley Feasibility Study for HVAC Upgrade		SHEET		2 OF 8	
ENGINEER				E M C Engineers, Inc. Denver, CO		DATE PREPARED		9-May-95	
						ESTIMATOR		T. Poeling	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 8012 REPAIR							
2	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	\$145.35	\$1,744	1-PLUM	0.546	\$141
3	3SWTCH	3-SPEED FAN SWITCH	EA.	12	\$14.54	\$174	1-ELEC	0.667	\$168
4		TOTAL - BUILDING 8002							
5									\$1,885
6									\$342
7									\$2,227
8		BUILDING 8038 REPAIR							
9	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	\$145.35	\$1,744	1-PLUM	0.546	\$141
10	3SWTCH	3-SPEED FAN SWITCH	EA.	12	\$14.54	\$174	1-ELEC	0.667	\$168
11		TOTAL - BUILDING 8038							
12									\$1,885
13									\$342
14									\$2,227
15		BUILDING 8042 REPAIR							
16	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	\$145.35	\$1,744	1-PLUM	0.546	\$141
17	3SWTCH	3-SPEED FAN SWITCH	EA.	12	\$14.54	\$174	1-ELEC	0.667	\$168
18		TOTAL - BUILDING 8042							
19									\$1,885
20									\$342
21									\$2,227
22		BUILDING 8052 REPAIR							
23	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	\$145.35	\$1,744	1-PLUM	0.546	\$141
24	3SWTCH	3-SPEED FAN SWITCH	EA.	12	\$14.54	\$174	1-ELEC	0.667	\$168
25		TOTAL - BUILDING 8052							
26									\$1,885
27									\$342
28									\$2,227
29		BUILDING 8014 REPAIR							
30	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	6	\$145.35	\$872	1-PLUM	0.546	\$71
31	3SWTCH	3-SPEED FAN SWITCH	EA.	6	\$14.54	\$87	1-ELEC	0.667	\$84
32		TOTAL - BUILDING 8014							
33									\$943
34									\$171
35									\$1,114
36		BUILDING 8040 REPAIR							
37	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	6	\$145.35	\$872	1-PLUM	0.546	\$71
38	3SWTCH	3-SPEED FAN SWITCH	EA.	6	\$14.54	\$87	1-ELEC	0.667	\$84
39		TOTAL - BUILDING 8040							
40									\$943
41									\$171
42									\$1,114
43		BUILDING 8048 REPAIR							
44	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	6	\$145.35	\$872	1-PLUM	0.546	\$71
45	3SWTCH	3-SPEED FAN SWITCH	EA.	6	\$14.54	\$87	1-ELEC	0.667	\$84
46		TOTAL - BUILDING 8048							
47									\$943
48									\$171
49									\$1,114

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		3	8
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		9-May-95	
						ESTIMATOR		T. Poeling	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 8050 REPAIR							
2	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	6	\$145.35	\$872	1-PLUM	0.546	\$71
3	3SWTCH	3-SPEED FAN SWITCH	EA.	6	\$14.54	\$87	1-ELEC	0.667	\$84
4		TOTAL - BUILDING 8050							\$1,114
5									
6		BUILDING 227 REPAIR							
7	CV1	CONTROL VALVE 1" (INCL. DEMO)	EA.	1	\$190.89	\$191	1-PLUM	0.7065	\$15
8	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	1	\$276.17	\$276	1-PLUM	1.0905	\$23
9		TOTAL - BUILDING 227							\$506
10									
11		BUILDING 402 REPAIR							
12	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	1	\$276.17	\$276	1-PLUM	1.0905	\$23
13									
14		BUILDING 7245 REPAIR							
15	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	1	\$397.29	\$397	1-PLUM	1.3335	\$29
16	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	2	\$190.89	\$382	1-STPI	1.5	\$65
17		TOTAL - BUILDING 7245							\$872
18									
19		BUILDING 7606 REPAIR							
20	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	2	\$397.29	\$795	1-PLUM	1.3335	\$57
21	PMP2HP	PUMP, 2 HP (INCL. DEMO)	EA.	1	\$867.26	\$867	Q-1	7.4	\$143
22		TOTAL - BUILDING 7606							\$852
23									\$1,011
24									\$1,863
25									
26	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	1	\$397.29	\$397	1-PLUM	1.3335	\$29
27	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	2	\$190.89	\$382	1-STPI	1.5	\$65
28		TOTAL - BUILDING 7654							\$872
29									
30		BUILDING 7804 REPAIR							
31	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	\$190.89	\$191	1-STPI	1.5	\$32
32									
33									
34									
35									

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		4	8
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		9-May-95	
						ESTIMATOR		T. Poeling	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 7856 REPAIR							
2	MTR1.5	FAN MOTOR, 1-1/2 HP	EA.	1	\$193.80	\$194	1-ELEC	2.667	\$56
3	MTR5	FAN MOTOR, 5 HP	EA.	1	\$232.56	\$233	1-ELEC	2.667	\$56
4	PATCH	PATCH DUCTWORK	JOB	1	\$4.85	\$5	1-SHEE	1	\$21
5		TOTAL - BUILDING 7654							\$564
6									
7		BUILDING 723 REPAIR							
8	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	4	\$14.54	\$58	Q-1	10	\$776
9	GASKET	CONDENSATE PUMP GASKET	EA.	8	\$14.54	\$116	1-PLUM	1	\$172
10	SHUTOFF	CONDENSATE SHUT-OFF CONTROLS	EA.	4	\$58.14	\$233	1-ELEC	1	\$84
11		TOTAL - BUILDING 723							\$1,439
12									
13		BUILDING 727 REPAIR							
14	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	\$190.89	\$191	1-STPI	1.5	\$32
15	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	4	\$14.54	\$58	Q-1	10	\$776
16	GASKET	CONDENSATE PUMP GASKET	EA.	8	\$14.54	\$116	1-PLUM	1	\$172
17	SHUTOFF	CONDENSATE SHUT-OFF CONTROLS	EA.	4	\$58.14	\$233	1-ELEC	1	\$84
18	PMP1/3HP	PUMP MOTOR, 1/3 HP (INCL. DEMO)	EA.	1	\$193.80	\$194	1-ELEC	3.78	\$79
19		TOTAL - BUILDING 727							\$1,935
20									
21		BUILDING 8390 REPAIR							
22	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	\$190.89	\$191	1-STPI	1.5	\$32
23	CV1	CONTROL VALVE 1" (INCL. DEMO)	EA.	2	\$190.89	\$382	1-PLUM	0.7065	\$30
24	CV0.75	CONTROL VALVE 3/4" (INCL. DEMO)	EA.	8	\$153.10	\$1,225	1-PLUM	0.666	\$115
25		TOTAL - BUILDING 8390							\$1,975
26									
27		BUILDING 202 REPAIR							
28	COIL	CONDENSER COIL (PLUS COVER)	EA	1	\$726.75	\$727	Q-5	13	\$252
29									
30		BUILDING 6914 REPAIR							
31	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	1	\$276.17	\$276	1-PLUM	1.0905	\$23
32	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	2	\$397.29	\$795	1-PLUM	1.3335	\$57
33	CV1.25	CONTROL VALVE 1-1/4" (INCL. DEMO)	EA.	2	\$232.56	\$465	1-PLUM	0.7995	\$34
34	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	2	\$190.89	\$382	1-STPI	1.5	\$65
35		TOTAL - BUILDING 6914							\$2,098

ENGINEER'S OPINION OF PROBABLE COST

PROJECT Fort Riley Feasibility Study for HVAC Upgrade
ENGINEER E M C Engineers, Inc.
 Denver, CO

SHEET 5 **OF** 8
DATE PREPARED 9-May-95
ESTIMATOR T. Poeling
CHECKED BY A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7739 REPAIR								
2	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	4	\$190.89	\$764	1-STPI	1.5	\$129	\$893
3										
4		BUILDING 6940 REPAIR								
5	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	\$190.89	\$191	1-STPI	1.5	\$32	\$223
6										
7		BUILDING 6620 REPAIR								
8	MTR7.5	FAN MOTOR, 7-1/2 HP	EA.	1	\$329.46	\$329	1-ELEC	2.8575	\$60	\$389
9	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	2	\$14.54	\$29	Q-1	10	\$388	\$417
10		TOTAL - BUILDING 6620								\$806
11										
12		BUILDING 820 REPAIR								
13	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	2	\$276.17	\$552	1-PLUM	1.0905	\$47	\$599
14	PMP10HP	PUMP MOTOR, 10 HP (INCL. DEMO)	EA.	2	\$455.43	\$911	1-ELEC	4	\$167	\$1,078
15	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	2	\$14.54	\$29	Q-1	10	\$388	\$417
16		TOTAL - BUILDING 820								\$2,094
17										
18		BUILDING 7485 REPAIR								
19	VSD10	VARIABLE SPEED DRIVE W/ CONTRLER, 10HP	EA.	1	\$3,197.70	\$3,198	1-ELEC	12.5	\$262	\$3,459
20										
21		BUILDING 7602 REPAIR								
22	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	5	\$494.19	\$2,471	Q-5	6.25	\$606	\$3,077
23	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	90	\$2.56	\$230	Q-1	0.2	\$349	\$579
24	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90	\$1.40	\$126	Q-14	0.08	\$133	\$258
25		TOTAL - BUILDING 7602								\$3,914
26										
27		BUILDING 7608 REPAIR								
28	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	5	\$494.19	\$2,471	Q-5	6.25	\$606	\$3,077
29	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	90	\$2.56	\$230	Q-1	0.2	\$349	\$579
30	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90	\$1.40	\$126	Q-14	0.08	\$133	\$258
31		TOTAL - BUILDING 7608								\$3,914
32										
33										
34										
35										

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET	6	OF	8
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		9-May-95	
						ESTIMATOR		T. Poeling	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 7652 REPAIR							
2	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	5	\$494.19	\$2,471	Q-5	6.25	\$606
3	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	90	\$2.56	\$230	Q-1	0.2	\$349
4	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90	\$1.40	\$126	Q-14	0.08	\$133
5		TOTAL - BUILDING 7652							\$3,914
6									
7		BUILDING 7658 REPAIR							
8	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	5	\$494.19	\$2,471	Q-5	6.25	\$606
9	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	90	\$2.56	\$230	Q-1	0.2	\$349
10	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90	\$1.40	\$126	Q-14	0.08	\$133
11		TOTAL - BUILDING 7658							\$3,914
12									
13		BUILDING 741 REPAIR							
14	STMCOIL2	36X84 STEAM COIL (INCL. DEMO)	EA.	4	\$896.33	\$3,585	Q-5	17.913	\$1,389
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									

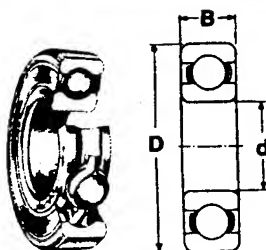
ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 7		OF 8	
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		9-May-95	
						ESTIMATOR		T. Poeling	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		SUMMARY - REPAIR COSTS							TOTAL
2		BUILDING 222							\$223
3		BUILDING 302							\$91
4		BUILDING 313							\$797
5		BUILDING 8056							\$744
6		BUILDING 7636							\$1,050
7		BUILDING 7612							\$208
8		BUILDING 7614							\$625
9		BUILDING 7810							\$417
10		BUILDING 7814							\$1,219
11		BUILDING 8002							\$2,227
12		BUILDING 8012							\$2,227
13		BUILDING 8038							\$2,227
14		BUILDING 8042							\$2,227
15		BUILDING 8052							\$2,227
16		BUILDING 8014							\$1,114
17		BUILDING 8040							\$1,114
18		BUILDING 8048							\$1,114
19		BUILDING 8050							\$1,114
20		BUILDING 227							\$506
21		BUILDING 402							\$300
22		BUILDING 7245							\$872
23		BUILDING 7606							\$1,863
24		BUILDING 7654							\$872
25		BUILDING 7804							\$223
26		BUILDING 7856							\$564
27		BUILDING 723							\$1,439
28		BUILDING 727							\$1,935
29		BUILDING 8390							\$1,975
30		BUILDING 202							\$979
31		BUILDING 6914							\$2,098
32		BUILDING 7739							\$893
33		BUILDING 6940							\$223
34									
35		SUBTOTAL REPAIR COSTS							\$35,706

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 8 OF 8		DATE PREPARED 9-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR T. Poeling		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		SUMMARY - REPAIR COSTS (cont')							\$806
2		BUILDING 6620							\$2,094
3		BUILDING 820							\$3,459
4		BUILDING 7485							\$3,914
5		BUILDING 7602							\$3,914
6		BUILDING 7608							\$3,914
7		BUILDING 7652							\$3,914
8		BUILDING 7658							\$3,914
9		BUILDING 741							\$4,975
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35		TOTAL REPAIR COSTS							\$62,698

**POWER
TRANSMISSION
BEARINGS**

ELECTRIC MOTOR GRADE BALL BEARINGS

ELE



NTN

CONTINUED ON NEXT PAGE

Ideal for motors, machine tools, generators, fans, pumps, power tools and appliances. Single row, deep groove bearings accommodate radial and thrust loads and can operate at very high speeds. Bearings are precision-made to exacting requirements and exceed rigid tolerances and running accuracies of ABEC-1 and

AFBMA standards. Double shields and double seals in the popular 600, 6000, 6200, 6300 and "R" series bearings. Shielded bearings have two precision-fitted steel shields, sealed bearings have neoprene seals for protection from contaminants. All bearings are permanently lubricated for a long life of quiet operation with minimum friction. Bearings meet Military Specification MIL-G-19709A operation temperature range of -20 to +225°F. Each bearing is individually wrapped and cartoned to protect against contamination. NTN brand.

Ideal for motors, fans, pumps, and appliances. Single row, deep groove bearings.

Fafnir

9100PP
9101PP
9105PP

BEARING DIMENSIONAL DATA—DOUBLE SHIELDS OR DOUBLE SEALS

NTN Model	Bore (d) mm Inches	Diameter (D) mm Inches	Width (B) mm Inches	NTN Model	Bore (d) mm Inches	Diameter (D) mm Inches	Width (B) mm Inches
R6	— .3750	— .8750	— .2812	6211	55 2.1654	100 3.9370	21 .8268
R8	— .5000	— 1.1250	— .3125	6212	60 2.3622	110 4.3307	22 .8661
R10	— .6250	— 1.3750	— .3438	6213	65 2.5591	120 4.7244	23 .9055
R12	— .7500	— 1.6250	— .3750	6214	70 2.7559	125 4.9213	24 .9449
R14	— .8750	— 1.8750	— .5000	6216	80 3.1496	140 5.5118	26 1.0236
R16	— 1.0000	— 2.0000	— .5000	—	—	—	—
627	7 .2756	22 .8661	7 .2756	6303	17 .6693	47 1.8504	14 .5512
608	8 .3150	22 .8661	7 .2756	6304	20 .7874	52 2.0472	15 .5906
629	9 .3543	26 1.0236	8 .3150	6305	25 .9843	62 2.4409	17 .6693
6000	10 .3937	26 1.0236	8 .3150	6306	30 1.1811	72 2.8346	19 .7488
6001	12 .4724	28 1.1024	8 .3150	6307	35 1.3780	80 3.1496	21 .8268
6005	25 .9843	47 1.8504	12 .4724	6308	40 1.5748	90 3.5433	23 .9055
6200	10 .3937	30 1.1811	9 .3543	6309	45 1.7717	100 3.9370	25 .9843
6201	12 .4724	32 1.2598	10 .3937	6310	50 1.9685	110 4.3307	27 1.0630
6202	15 .5906	35 1.3780	11 .4331	6311	55 2.1654	120 4.7244	29 1.1417
6203	17 .6693	40 1.5748	12 .4724	6312	60 2.3622	130 5.1181	31 1.2205
6203**	† .6250	40 1.5748	12 .4724	6313	65 2.5591	140 5.5118	33 1.2992
6204	20 .7874	47 1.8504	14 .5512	6314	70 2.7559	150 5.9055	35 1.3780
6205	25 .9843	52 2.0472	15 .5906	—	—	—	—
6206	30 1.1811	62 2.4409	16 .6299	6315	75 2.9528	160 6.2992	37 1.4550
6207	35 1.3780	72 2.8346	17 .6693	6316	80 3.1496	170 6.6929	39 1.5335
6208	40 1.5748	80 3.1496	18 .7087	6318	90 3.5433	190 7.4803	43 1.6825
6209	45 1.7716	85 3.3464	19 .7480	6319	95 3.7402	200 7.8740	45 1.7717
6210	50 1.9685	90 3.5433	20 .7874	6320	100 3.9370	215 8.4646	47 1.8506

SELECTION AND ORDERING INFORMATION

Fafnir	SKF	NUMBERING INTERCHANGE NSK	SNR	FAG	Koyo	NTN Model	Stock No.	List	Each	Sh
SERIES R (EXTRA SMALL and EXTRA LIGHT) DOUBLE SHIELD										
S3KDD	—	R6ZZ	—	R6.2ZR	EE3SZZ	R6-ZZ	1L004	\$15.07	\$7.72	0.1
S5KDD	—	R8ZZ	—	R8.2ZR	EE4SZZ	R8-ZZ	1L005	15.86	8.12	0.1
S7KDD	—	R10ZZ	—	EE5.2ZR	EE5SZZ	R10-ZZ	1L006	18.23	9.33	0.1
S8KDD	—	R12ZZ	—	EE6.2ZR	EE6SZZ	R12-ZZ	1L007	21.62	11.06	0.1
S9KDD	—	R14ZZ	—	EE8.2ZR	EE8SZZ	R14-ZZ	1L008	24.66	12.62	0.1
S10KDD	—	R16ZZ	—	EE9.2ZR	EE9SZZ	R16-ZZ	1L009	28.87	14.77	0.1
SERIES R (EXTRA SMALL and EXTRA LIGHT) DOUBLE SEAL										
S3PP	—	R6VV	—	EE3.2RSR	EE3S2RS	R6-LL	1L038	22.41	11.46	0.1
S5PP	—	R8VV	—	EE4.2RSR	EE4S2RS	R8-LL	1L039	23.98	12.27	0.1
S7NPP	—	R10VV	—	EE5.2RSR	EE5S2RS	R10-LL	1L040	23.38	11.96	0.1
S8PP	—	R12VV	—	EE6.2RSR	EE6S2RS	R12-LL	1L041	26.80	13.72	0.1
N/A	—	R14VV	—	EE8.2RSR	EE8S2RS	R14-LL	1L042	31.39	16.06	0.1
S10PP2	—	R16VV	—	EE9.2RSR	EE9S2RS	R16-LL	1L043	33.46	17.12	0.1
SERIES 600 (SMALL) DOUBLE SHIELD										
38KDD	608-2Z	608ZZ	—	608.2ZR	608ZZ	608-ZZ	1L001	10.30	5.27	0.1
37KDD	627-2Z	627ZZ	—	627.2ZR	627ZZ	627-ZZ	1L002	10.00	5.12	0.1
39KDD	629-2Z	629ZZ	—	629.2ZR	629ZZ	629-ZZ	1L003	12.07	6.18	0.1
SERIES 600 (SMALL) DOUBLE SEAL										
38PP2	608-2RS	608VV	—	608.2RSR	608-2RS	608-LL	1L035	13.27	6.79	0.1
37PP2	627-2RS	627VV	—	627.2RSR	627-2RS	627-LL	1L036	18.53	9.48	0.1
39PP	629-2RS	629VV	—	629.2RSR	629-2RS	629-LL	1L037	18.19	9.31	0.1
SERIES 600 (EXTRA LIGHT) DOUBLE SHIELD										
9100KDD	6000-2Z	6000ZZ	6000ZZ	6000.2ZR	6000ZZ	6000-ZZ	1L010	14.17	7.25	0.1
9101KDD	6001-2Z	6001ZZ	6001ZZ	6001.2ZR	6001ZZ	6001-ZZ	1L011	16.09	8.23	0.1
9105KDD	6005-2Z	6005ZZ	6005ZZ	6005.2ZR	6005ZZ	6005-ZZ	1L012	22.78	11.66	0.1

(**) 6203/15.875 (*) 15.875

303KDD 6
304KDD 6
305KDD 6
306KDD 6
307KDD 6
308KDD 6
309KDD 6
310KDD 6
311KDD 6
312KDD 6
313KDD 6
314KDD 6
315KDD 6
316KDD 6
317KDD 6
318KDD 6
319KDD 6
320KDD 6

303PP 6
304PP 6
305PP 6
306PP 6
307PP 6
308PP 6
309PP 6
310PP 6
311PP 6
312PP 6

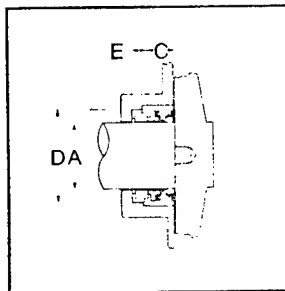
6203-ZZ/15.875

**PUMPS:
ACCESSORIES**

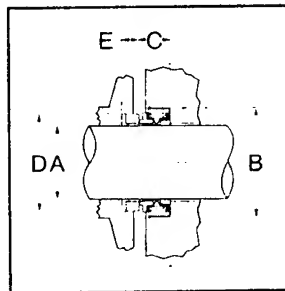
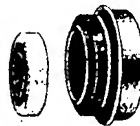
JOHN CRANE PUMP SHAFT SEALS



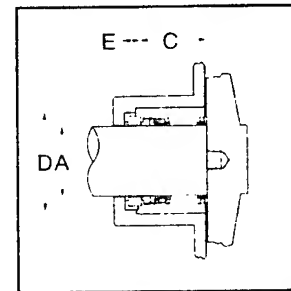
Type 6



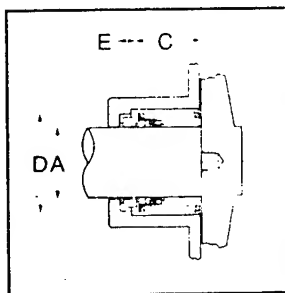
Type 6A



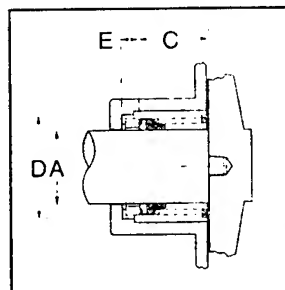
Type 1



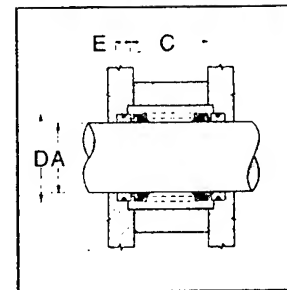
Type 2



Type 21



Type 21Db1



Type 6—Elastomer bellows seal designed for use in small centrifugal water pumps, deep and shallow well jet pumps, and other positive displacement pumps. Full convolution elastomer bellows provides maximum flexibility in compensating for shaft movement and wear. Temperatures: -49 to 400°F. Pressures: Up to 75 PSIG. Speeds: Up to 1000 FPM or 3600 RPM.

Type 6A—Elastomer bellow seal for use in low pressure, small diameter rotary shaft applications. One piece construction allows for fast, easy production line installation by press fitting seal in equipment housing bore.

Type 1—Designed for use in pumps, mixers, blenders and other rotary shaft equipment. Can handle pressures to 425 PSIG and temperatures from -40 to 400°F. Can be field repaired to

minimize costs, downtime and lost revenue.

Type 2—Designed for confined space requirements and limited gland depth in pumps, mixers and other rotary shaft equipment. Can handle temperatures of -40 to 400°F and pressures up to 425 PSIG.

Type 21—General purpose seal made of stainless steel. Can handle pressures up to 150 PSIG and temperatures of -40 to 400°F.

Type 21, Double Seal—Recommended where corrosives, sewerage type or abrasive liquids are being pumped. Liquid is circulated at 5 to 20 PSI pressure above the pressure against the inboard seal to create a sealing barrier.

CONTINUED ON NEXT PAGE

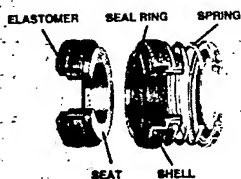
JOHN CRANE PUMP SHAFT SEALS

PUMPS: ACCESSORIES

REPLACEMENT SEAL SPECIFICATIONS AND ORDERING DATA

Seal Type	A Shaft Size	B Seal Bore	C Nominal Working Length	D Seat Bore	E Seat Thickness	Material Content Code	Stock No.	List	Each	Lots 6	Shpg. Wt.
6	5/8"	—	23/32"	13/16"	11/32"	BT2C1	SP403	\$9.35	\$6.12	\$5.81	0.1
6	5/8"	—	23/32"	13/16"	11/32"	BT1C1	SP404	9.35	5.81	5.52	0.1
6	5/8"	—	23/32"	1 1/4	13/32	BT2C1	SP405	7.90	5.96	5.66	0.2
6	5/8"	—	23/32"	1 1/4	13/32	BT1C1	SP406	7.90	5.62	5.34	0.1
6	5/8"	—	23/32"	1 1/4	13/32	BF1C1	SP407	15.10	7.38	7.01	0.1
6	5/8"	—	23/32"	1 1/4	13/32	XF1C1	SP408	23.55	14.23	13.52	0.1
6	5/8"	—	13/16"	1 1/4	13/32	BT2C1	SP409	9.20	7.38	7.01	0.1
6	5/8"	—	13/16"	1 1/4	13/32	BT1C1	SP410	7.90	6.63	6.30	0.1
6	5/8"	—	23/32"	1 3/8	13/32	BT2C1	SP411	10.00	8.41	7.99	0.1
6	5/8"	—	23/32"	1 3/8	13/32	BT1C1	SP412	12.75	6.49	6.17	0.1
6	3/4	—	23/32"	1 3/8	13/32	XF1C1	SP413	25.25	17.27	16.41	0.1
6	3/4	—	23/32"	1 3/8	13/32	BF1C1	SP414	15.20	8.59	8.16	0.1
6	3/4	—	13/16"	1 7/16	13/32	BT1C1	SP416	12.25	6.61	6.28	0.1
6	1	—	13/16"	1 3/8	7/16	BT2C1	SP417	35.20	27.85	26.46	0.2
6A	5/8"	1 7/16"	29/64	Shaft Mtd	7/32	BT171	SP402	10.20	4.72	4.48	0.1
6A	5/8"	1 7/16"	29/64	Shaft Mtd	7/32	XF171	SP365	32.55	19.91	18.91	0.1
6A	5/8"	1 7/16"	29/64	—	7/32	BT1C1	SP366	12.00	6.26	5.95	0.1
6A	5/8"	1 7/16"	29/64	1 1/16	1 1/2	BT2C1	SP367	29.70	23.76	22.57	0.1
6A	5/8"	1 7/16"	29/64	1 1/16	1 1/2	BT2C1	SP368	11.88	7.98	7.58	0.1
6A	5/8"	1 7/16"	29/64	1 1/4	13/32	BT1C1	SP369	11.88	9.45	8.98	0.1
1	1	—	19/16	1 5/8	7/16	BF2C1	SP370	56.16	31.30	29.74	0.2
1	1 1/16	—	19/32	1 3/4	13/32	BF2C1	SP371	169.73	135.80	129.01	0.3
1	1 1/8	—	13/16	1 3/4	7/16	BF271	SP372	141.08	72.10	68.50	0.3
1	1 1/8	—	1 5/8	1 3/4	7/16	BF2C1	SP373	84.65	80.40	76.38	0.3
1	1 1/4	—	1 5/8	1 7/8	7/16	BF2C1	SP374	116.20	100.50	95.48	0.3
1	1 7/16	—	1 11/16	2 1/16	7/16	BF2C1	SP375	190.75	152.75	145.11	0.3
1	1 5/8	—	2	2 1/16	1/2	BF271	SP376	172.70	138.20	131.29	0.6
1	1 5/8	—	2	2 1/16	1/2	BF2C1	SP377	184.97	138.20	131.29	0.5
1	1 3/4	—	2	2 1/2	1/2	BF2C1	SP378	171.22	125.05	118.80	0.5
1	2 1/16	—	2 3/8	2 7/8	9/16	BF271	SP379	531.30	241.50	229.43	0.8
2	1/2	—	13/16	1	5/16	BT2C1	SP380	22.28	17.82	16.93	0.1
2	5/8	—	7/8	1 1/4	3/8	BF2C1	SP381	24.85	19.89	18.90	0.2
2	5/8	—	7/8	1 1/4	13/32	BF2C1	SP382	19.14	15.31	14.54	0.1
2	3/4	—	7/8	1 3/8	13/32	BF2C1	SP383	20.07	17.05	16.20	0.2
2	1	—	1 1/16	1 3/8	7/16	BF2C1	SP423	55.90	44.70	42.47	0.2
2	1 1/8	—	1 1/16	1 3/4	7/16	BF871	SP424	96.80	77.45	73.58	0.3
2	1 1/8	—	1 1/16	1 3/4	7/16	BF2C1	SP425	93.15	74.50	70.78	0.3
2	1 1/4	—	1 1/16	1 7/8	7/16	BF2C1	SP426	82.40	60.80	57.76	0.3
21	1/2	—	13/16	1	5/16	BF1C1	SP418	13.80	11.04	10.49	0.1
21	9/16	—	27/32	1 1/32	5/16	BF141	SP419	14.35	11.45	10.88	0.1
21	5/8	—	23/32	1 1/4	13/32	BT1C1	SP420	14.80	11.84	11.25	0.1
21	5/8	—	13/16	1 5/32	5/16	BT1C1	SP421	11.25	8.98	8.53	0.1
21	5/8	—	7/8	1 1/4	3/8	BF1C1	SP422	19.30	15.45	14.68	0.1
21	5/8	—	7/8	1 1/4	13/32	BF1C1	SP384	11.22	11.13	10.57	0.1
21	5/8	—	7/8	1 1/4	13/32	BF1C1	SP385	11.20	11.13	10.57	0.1
21	5/8	—	7/8	1 1/4	13/32	BF1C1	SP386	11.22	11.13	10.57	0.1
21	5/8	—	1 1/16	1 3/4	5/16	BF1C1	SP387	16.60	8.91	8.46	0.1
21	3/4	—	7/8	1 3/8	13/32	BF1C1	SP389	35.15	11.88	11.29	0.1
21	3/4	—	7/8	1 3/8	13/32	XF1C1	SP388	21.30	17.05	16.20	0.1
21	1	—	1 1/16	1 5/8	7/16	BF1C1	SP390	51.60	32.95	31.30	0.2
21	1 1/8	—	1 1/16	1 3/4	7/16	BF1C1	SP391	73.90	16.17	15.36	0.2
21	1 1/8	—	1 1/16	1 3/4	7/16	BF171	SP392	75.90	53.20	50.54	0.3
21	1 1/8	—	1 1/16	1 3/4	7/16	BF171	SP393	101.95	57.20	54.34	0.3
21	1 1/4	—	1 1/16	1 7/8	7/16	BF1C1	SP394	76.23	18.46	17.54	0.1
21	1 1/4	—	1 3/8	1 7/8	7/16	BF1C1	SP395	88.05	52.80	50.16	0.3
21	1 1/4	—	1 1/16	1 7/8	7/16	BF171	SP396	79.40	61.80	58.71	0.3
21	1 3/8	—	1 1/8	2	7/16	BF1C1	SP397	96.60	71.20	67.64	0.1
21	1 1/2	—	1 1/8	2 1/8	7/16	BF1C1	SP398	118.50	65.95	62.65	0.3
21	1 3/4	—	1 3/8	2 1/2	1/2	BF171	SP399	219.30	81.80	77.71	0.7
21DBL	1 7/8	—	1 3/4	2 5/8	1/2	BF1C1	SP400	328.10	223.00	211.85	0.8
21DBL	2 3/4	—	3 3/4	3 1/2	5/8	BF171	SP401	467.00	373.75	355.06	2.2

(*) Material content is listed below with typical construction details.



ELASTOMER
B=BUNA
X=VITON

SEAL RING
F=CARBON
T=MOLDED PLASTIC

MATERIAL CODE FOR SEALS

HARDWARE OR SHELL
1=STAINLESS STEEL
2=BRASS

STATIONARY SEAT
C=CERAMIC
7=NI RESIST
4=BRONZE

SPRING
1=STAINLESS STEEL

SEE WARRANTY INFORMATION ON PAGE OPPOSITE INSIDE BACK COVER

2273

APPENDIX D

**PROPOSED HVAC SYSTEM REPLACEMENT
CALCULATIONS**

PREFACE TO APPENDIX D

The beginning portion of this Appendix contains the general backup data used in the HVAC system replacement calculations for all buildings evaluated. This data includes:

- Material and labor cost data tables.
- Maintenance cost data.
- Manufacturers literature and cost data.

Following the general backup data is the specific detailed backup for each building evaluated in this study.



MATERIAL & LABOR COST LOOK UP TABLE										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								
ENGINEER		E M C Engineers, Inc. Denver, CO								
		SHEET 1 OF 6								
		DATE PREPARED 9-May-95								
		PREPARED BY C. Wohler								
		CHECKED BY A. Niemeyer								
Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
1	10"FLEX	10 IN. DIA. FLEX DUCT	L.F.	\$3	\$2.55	Q-9	\$18.7	0.11	2020	254
2	10"VAVDP	10" VAV ROUND MOTORIZED DAMPER, ELEC	EA.	\$311	\$300.87	1-SHEE	\$20.8	0.44	8516	286
3	12"RDUCT	12 IN. DIA. ROUND DUCT, GAL. STL	L.F.	\$3	\$2.73	Q-9	\$18.7	0.13	5450	260
4	12X6SA	12X6 SA GRILLES	EA.	\$10	\$9.84	1-SHEE	\$20.8	0.35	2020	278
5	14X6SA	14X6 RA GRILLES	EA.	\$11	\$10.85	1-SHEE	\$20.8	0.35	1040	279
6	3SWTCH	3-SPEED FAN SWITCH	EA.	\$15	\$14.54	1-ELEC	\$20.9	0.67	1700	E139
7	6"RDUCT	6 IN. DIA. ROUND DUCT, GAL. STL	L.F.	\$1	\$1.37	Q-9	\$18.7	0.06	5420	260
8	8"RDUCT	8 IN. DIA. ROUND DUCT, GAL. STL	L.F.	\$2	\$1.79	Q-9	\$18.7	0.08	5430	260
9	9X9DIFF	9X9 SA DIFFUSERS	EA.	\$59	\$56.69	1-SHEE	\$20.8	0.57	2020	278
10	ACCU10	10 TON ACCU	EA.	\$3,725	\$3,609.53	Q-5	\$19.4	32.00	600	252
11	ACCU15	15 TON ACCU	EA.	\$5,350	\$5,184.15	Q-5	\$19.4	40.00	650	252
12	ACCU4	4 TON ACCU	EA.	\$1,450	\$1,405.05	Q-5	\$19.4	17.78	400	252
13	ACCU5	5 TON ACCU	EA.	\$1,775	\$1,719.98	Q-5	\$19.4	26.67	500	252
14	ACCU7.5	7.5 TON ACCU	EA.	\$3,225	\$3,125.03	Q-5	\$19.4	29.09	550	252
15	ACTUAT	SMALL ELECTRIC ACTUATOR	EA.	\$100	\$96.90	1-ELEC	\$20.9	0.35	Estimated	
16	AHU10000	10,000 CFM AHU, COOLING ONLY	EA.	\$4,975	\$4,821	Q-6	\$20.1	44.44	1550	234
17	AHU12000	12,000 CFM AHU, COOLING ONLY	EA.	\$5,675	\$5,499	Q-6	\$20.1	52.17	1600	234
18	AHU1300	1,300 CFM AHU, COOLING ONLY	EA.	\$1,975	\$1,914	Q-5	\$19.4	13.33	1100	234
19	AHU14000	14,000 CFM AHU, COOLING ONLY	EA.	\$6,700	\$6,492	Q-6	\$20.1	57.14	1650	234
20	AHU1900	1,900 CFM AHU, COOLING ONLY	EA.	\$2,200	\$2,132	Q-5	\$19.4	14.55	1200	234
21	AHU3200	3,200 CFM AHU, COOLING ONLY	EA.	\$2,600	\$2,519	Q-5	\$19.4	20.00	1300	234
22	AHU5400	5,400 CFM AHU, COOLING ONLY	EA.	\$3,925	\$3,803	Q-6	\$20.1	30.00	1400	234
23	AHU6750	6,750 CFM AHU, HEATING ONLY	EA.	\$4,262	\$4,130	Q-5	\$19.4	35.00	1300	234
24	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	\$4,575	\$4,433	Q-6	\$20.1	40.00	1500	234
25	AHUCNTL	AHU SA CONTROLLER	EA.	\$220	\$213.19	1-ELEC	\$20.9	2.00	BARBER	brb/men
26	AHUH1000	10,000 CFM AHU	EA.	\$5,970	\$5,785	Q-6	\$20.1	46.67	1550	234
27	AHUH1200	12,000 CFM AHU	EA.	\$6,810	\$6,599	Q-6	\$20.1	54.78	1600	234
28	AHUH1300	1,300 CFM AHU	EA.	\$2,370	\$2,297	Q-5	\$19.4	14.00	1100	234
29	AHUH1900	1,900 CFM AHU	EA.	\$2,640	\$2,558	Q-5	\$19.4	15.27	1200	234
30	AHUH3200	3,200 CFM AHU	EA.	\$3,120	\$3,023	Q-5	\$19.4	21.00	1300	234
31	AHUH5400	5,400 CFM AHU	EA.	\$4,710	\$4,564	Q-6	\$20.1	31.50	1400	234
32	AHUH8000	8,000 CFM AHU	EA.	\$5,490	\$5,320	Q-6	\$20.1	42.00	1500	234
33	AHUHEAT	COST OF HEATING COIL IN AHU	EA.	21.00%	\$0.20	5%			2200	235
34	BDRD36	CAST IRON RADIATOR, 36.5 MBH	EA.	\$625	\$605.63	Q-5	\$19.4	2.00	4040	194



MATERIAL & LABOR COST LOOK UP TABLE

SHEET 2 OF 6

PROJECT		Fort Riley Feasibility Study for HVAC Upgrade					DATE PREPARED		9-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO					PREPARED BY		C. Wohliert	
							CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
35	BOIL6.97	CAST IRON STEAM BOILER, 6.97 MBH	EA.	\$53,000	\$51,357	Q-7	\$20.6	400.00	2540	172
36	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	\$510	\$494.19	Q-5	\$19.4	6.25	2170	245
37	CNTV0.5	CONTROL VALVE 1/2"	EA.	\$150	\$145.35	1-PLUM	\$21.5	0.36	8190	272
38	CNTV0.75	CONTROL VALVE 3/4"	EA.	\$158	\$153.10	1-PLUM	\$21.5	0.44	8200	272
39	CNTV1	CONTROL VALVE 1"	EA.	\$197	\$190.89	1-PLUM	\$21.5	0.47	8210	272
40	CNTV1.25	CONTROL VALVE 1-1/4"	EA.	\$240	\$232.56	1-PLUM	\$21.5	0.53	8090	272
41	CNTV1.5	CONTROL VALVE 1-1/2"	EA.	\$285	\$276.17	1-PLUM	\$21.5	0.73	8220	272
42	CNTV2	CONTROL VALVE 2"	EA.	\$410	\$397.29	1-PLUM	\$21.5	0.89	8230	272
43	CNTV2.5	CONTROL VALVE 2-1/2"	EA.	\$965	\$935.09	1-PLUM	\$21.5	3.56	8570	272
44	CNTVLV2	2" CONTROL VALVE,3-WAY,DDC	EA.	\$1,000	\$969.00	1-PLUM	\$21.5	3.00	BARBER	COLMAN
45	COIL	CONDENSER COIL (PLUS COVER)	EA	\$750	\$726.75	Q-5	\$19.4	13.00	1380	244
46	CONT	CONTINGENCY			20.00%					
47	CT1	COOLING TOWER, <60 TONS	TON-AC	\$100	\$96.90	Q-6	\$20.1	23.75	100	253
48	CUPIP0.75	COPPER PIPE TYPE L, 0.75" W/HANGERS	L.F.	\$2	\$1.84	1-PLUM	\$21.5	0.11	2180	74
49	CUPIP2	COPPER PIPE TYPE L, 2" W/HANGERS	L.F.	\$6	\$5.96	1-PLUM	\$21.5	0.19	2260	74
50	CUPIP3	COPPER PIPE TYPE L, 3" W/HANGERS	L.F.	\$12	\$11.19	Q-1	\$19.4	0.29	2300	74
51	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	\$150	\$145.35	1-PLUM	\$21.5	0.55	8190	272
52	CV0.75	CONTROL VALVE 3/4" (INCL. DEMO)	EA.	\$158	\$153.10	1-PLUM	\$21.5	0.67	8200	272
53	CV1	CONTROL VALVE 1" (INCL. DEMO)	EA.	\$197	\$190.89	1-PLUM	\$21.5	0.71	8210	272
54	CV1.25	CONTROL VALVE 1-1/4" (INCL. DEMO)	EA.	\$240	\$232.56	1-PLUM	\$21.5	0.80	8090	272
55	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	\$285	\$276.17	1-PLUM	\$21.5	1.09	8220	272
56	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	\$410	\$397.29	1-PLUM	\$21.5	1.33	8230	272
57	CV2.5	CONTROL VALVE 2-1/2" (INCL. DEMO)	EA.	\$965	\$935.09	1-PLUM	\$21.5	5.33	8570	272
58	DMP28X44	DAMPER W/ ACT, 28" X 44"	EA.	\$287	\$278.10	Q-9	\$18.7	2.00	160	E122
59	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	\$197	\$190.89	1-STPI	\$21.5	1.50	9052	273
60	DTINSL0.5	0.5" FIBERGLASS LINER, 2LB DENSITY	S.F.	\$0	\$0.37	Q-14	\$18.4	0.04	3050	196
61	DTINSL1"	DUCT INSULATION, 1" THICK	S.F.	\$1	\$0.48	Q-14	\$18.4	0.05	3060	196
62	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	\$1	\$0.83	Q-14	\$18.4	0.05	3080	196
63	DTMOD1	MODIFY DUCTWORK FOR STEAM COIL	EA.	\$200	\$193.80	Q-5	\$19.4	20.00	Estimated	
64	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	\$0	\$0.47	Q-10	\$19.4	0.09	540	253
65	DUCT200	GAL. STEEL DUCTWORK, UNDER 200 LB.	LB.	\$2	\$1.51	Q-10	\$19.4	0.10	500	253
66	DUCT2000	GAL. STEEL DUCTWORK, 1000 TO 2000 LB.	LB.	\$0	\$0.45	Q-10	\$19.4	0.09	560	253
67	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	\$0	\$0.47	Q-10	\$19.4	0.10	520	253
68	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	\$0	\$0.45	Q-10	\$19.4	0.09	570	253



MATERIAL & LABOR COST LOOK UP TABLE

MATERIAL & LABOR COST LOOK UP TABLE										SHEET 3 OF 6	
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED 9-May-95	
ENGINEER		E M C Engineers, Inc.								PREPARED BY C. Wohler	
		Denver, CO								CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.	
69	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	\$25	\$24.23	1-ELEC	\$20.9	0.80	5230	271	
70	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	\$1	\$0.83	1-ELEC	\$20.9	0.06	9120	E82	
71	ELE-SWIT	DDC SWITCH	EA.	\$72	\$69.77	1-STPI	\$21.5	0.50	9045	273	
72	EXHOD1.3	ROOF EXHAUSTER, 1,300 CFM	EA.	\$495	\$479.66	Q-20	\$19.2	4.00	7780	267	
73	EXHOD11	ROOF EXHAUSTER, 11,000 CFM	EA.	\$2,050	\$1,986.45	Q-20	\$19.2	10.00	7840	267	
74	EXHOD3.6	ROOF EXHAUSTER, 3,600 CFM	EA.	\$850	\$823.65	Q-20	\$19.2	5.00	7780	267	
75	FAC1	FURNACE AIR CONDITIONER, 4 TON	EA.	\$1,840	\$1,782.96	Q-9	\$18.7	20.00	LENNOX		
76	FAC2	FURNACE AIR CONDITIONER, 5 - 6 TON	EA.	\$2,680	\$2,596.92	Q-10	\$19.4	24.00	LENNOX		
77	FANBRG	FAN BEARING (INCL. DEMO)	EA.	\$17	\$15.99	Q-9	\$18.7	4.00	Grainger	286	
78	FC-1TON	FAN COIL, CW, CABINET, 1 TON	EA.	\$695	\$673.46	Q-6	\$20.1	2.67	120	236	
79	FTR1.25ST	FINNED TUBE RAD. - 1.25" STEEL TUBE, STEE	L.F.	\$30	\$28.59	Q-1	\$19.4	0.44	1250	194	
80	FURN125	PULSE COMB FURNACE 125,000 BTUH	EA.	\$2,500	\$2,422.50	Q-10	\$19.4	26.00	LENNOX		
81	FURN150	PULSE COMB FURNACE 150,000 BTUH	EA.	\$2,800	\$2,713.20	Q-10	\$19.4	28.00	LENNOX		
82	GASCN	FLEXIBLE CONNECTOR 12" LONG	EA.	\$8	\$7.90	1-PLUM	\$21.5	0.22	200	64	
83	GASKET	CONDENSATE PUMP GASKET	EA.	\$15	\$14.54	1-PLUM	\$21.5	1.00	700	122	
84	HWBLR1	765 MBH HOT WATER BOILER (Cast Iron)	EA.	\$5,525	\$5,353.73	Q-7	\$20.6	58.18	3240	172	
85	HWBLR2	1,613 MBH HOT WATER BOILER	EA.	\$10,100	\$9,786.90	Q-7	\$20.6	76.19	3300	172	
86	HWBLR3	2,312 MBH HOT WATER BOILER	EA.	\$14,500	\$14,050.50	Q-7	\$20.6	88.89	3340	172	
87	HWBLR4	400 MBH HW BOILER, PWR BURNER, CONTRO	EA.	\$5,350	\$5,184.15	Q-6	\$20.1	30.00	6160	173	
88	HWP1	1/3 HP, CI FLANGE, IN-LINE, 3/4"-1-1/2" SIZE	EA.	\$310	\$300.39	Q-1	\$19.4	2.67	2100	166	
89	INSLPIP0.7	0.75" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	\$0.63	\$0.61	Q-14	\$18.4	0.07	6860	201	
90	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	\$0.64	\$0.62	Q-14	\$18.4	0.07	6870	201	
91	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THC	L.F.	\$1.44	\$1.40	Q-14	\$18.4	0.08	7120	201	
92	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	\$1.51	\$1.46	Q-14	\$18.4	0.08	7140	201	
93	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	\$1.65	\$1.60	Q-14	\$18.4	0.09	7150	201	
94	INSLPIP3	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	\$1.71	\$1.66	Q-14	\$18.4	0.09	7160	201	
95	INSLPIP4	4" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	\$1.95	\$1.89	Q-14	\$18.4	0.11	7180	201	
96	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	\$2.25	\$2.18	Q-14	\$18.4	0.15	7200	201	
97	INT-VN1,10	1 SIDE INLET VANES RET-FIT, 21"	EA.	\$1,320	\$1,279.08	Q-20	\$19.2	5.50	BARRY	BLOWER	
98	INT-VN1,3	1 SIDE INLET VANES RET-FIT, 13"	EA.	\$1,055	\$1,022.30	Q-20	\$19.2	5.50	BARRY	BLOWER	
99	INT-VN1,40	1 SIDE INLET VANES RET-FIT, 38"	EA.	\$2,665	\$2,582.39	Q-20	\$19.2	6.00	BARRY	BLOWER	
100	IRHEAT	GAS FIRED IR TUBE SYSTEMS / BURNER	EA.	\$1,615	\$1,564.94	Q-6	\$20.1	18.24	CoRayVac		
101	IRHT30	GAS FIRED IR HEATER, 30 MBH	EA.	\$335	\$324.62	Q-5	\$19.4	2.67	100	186	
102	KHRU1	KITCHEN HEAT RECOVERY UNIT, 3000 CFM	EA.	\$13,200	\$12,790.80	Q-6	\$20.1	25.00	Gaylord	QUOTE	



MATERIAL & LABOR COST LOOK UP TABLE

PROJECT Fort Riley Feasibility Study for HVAC Upgrade

ENGINEER E M C Engineers, Inc.

Denver, CO

SHEET

4 OF 6

DATE PREPARED

9-May-95

PREPARED BY

C. Wohler

CHECKED BY

A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
103	KHRU2	KITCHEN HEAT RECOVERY UNIT, 4250 CFM	EA.	\$14,640	\$14,186.16	Q-6	\$20.1	30.00	Gaylord	QUOTE
104	KHRU5	KITCHEN HEAT RECOVERY UNIT, 8,500 CFM	EA.	\$18,000	\$17,442.00	Q-6	\$20.1	32.00	Gaylord	QUOTE
105	KHRU8	KITCHEN HEAT RECOVERY UNIT, 14,500 CFM	EA.	\$22,800	\$22,093.20	Q-6	\$20.1	36.00	Gaylord	QUOTE
106	KHRU9C	KITCHEN HEAT RECOVERY UNIT, 19,000 CFM	EA.	\$29,200	\$28,294.80	Q-6	\$20.1	40.00	Gaylord	QUOTE
107	MCUPIP1	COPPER TUBE, TYPE L, 3/4" OD	L.F.	\$1	\$1.41	1-PLUM	\$21.5	0.10	3180	74
108	MCUPIP2	COPPER TUBE, TYPE L, 1-1/4" OD	L.F.	\$3	\$2.60	1-PLUM	\$21.5	0.13	3180	74
109	MNT-AHU	MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.			Q-6	\$20.1	25.00	Estimated	
110	MNT-AHU1	MAINT. ON AHU - INSPEC. / YR <= 5000 CFM	EA.			Q-6	\$20.1	19.00	Estimated	
111	MNT-BLR1	MAINT. ON BOILERS - >2.5 MBH	EA.	\$100	\$96.90	Q-6	\$20.1	25.00	Estimated	
112	MNT-BLR2	MAINT. ON BOILERS - <2.5 MBH	EA.	\$50	\$48.45	Q-6	\$20.1	17.00	Estimated	
113	MNT-CH1	MAINT. ON CHLR, AIR-CLD, <20 TONS. / YR	EA.	\$0.00	\$0.00	Q-6	\$20.1	10.00	Estimated	
114	MNT-CT1	MAINT. ON CLG TOWER, <20 TONS. / YR (EXIS)	EA.	\$50.00	\$48.45	Q-6	\$20.1	15.00	Estimated	
115	MNT-FAC	MAINT. ON FAC - INSPEC. / YR	EA.			Q-6	\$20.1	4.00	Estimated	
116	MNT-FC	MAINT. ON FCs - INSPEC. / YR	EA.			Q-6	\$20.1	4.00	Estimated	
117	MNT-IR	MAINT. ON IR HEATERS - INSPEC. / YR	EA.			Q-6	\$20.1	4.00	Estimated	
118	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.			Q-6	\$20.1	4.00	Estimated	
119	MODBLR1	MODULAR HW BOILER, 320 MBH	EA.	\$2,725	\$2,641	Q-7	\$20.6	40.00	3140	172
120	MTR1.5	FAN MOTOR, 1-1/2 HP	EA.	\$200	\$193.80	1-ELEC	\$20.9	2.67	150	E176
121	MTR5	FAN MOTOR, 5 HP	EA.	\$240	\$232.56	1-ELEC	\$20.9	2.67	250	E176
122	MTR7.5	FAN MOTOR, 7-1/2 HP	EA.	\$340	\$329.46	1-ELEC	\$20.9	2.86	300	E176
123	MZ15TON	15 TON MULTIZONE AHU	EA.	\$32,110	\$31,115	Q-7	\$20.6	145.00	2100	239
124	OH	OVERHEAD			16.80%					
125	PATCH	PATCH DUCTWORK	JOB	\$5	\$4.85	1-SHEE	\$20.8	1.00	Estimated	
126	PMP1.5HP	PUMP, 1.5 HP	EA.	\$870	\$843.03	Q-1	\$19.4	5.33	4040	166
127	PMP1/3HP	PUMP MOTOR, 1/3 HP (INCL. DEMO)	EA.	\$200	\$193.80	1-ELEC	\$20.9	3.78	100	E176
128	PMP10HP	PUMP MOTOR, 10 HP (INCL. DEMO)	EA.	\$470	\$455.43	1-ELEC	\$20.9	4.00	350	E176
129	PMP2HP	PUMP, 2 HP (INCL. DEMO)	EA.	\$895	\$867.26	Q-1	\$19.4	7.40	4090	166
130	PMP2ND	PUMP, 2 HP, NO DEMO	EA.	\$895	\$867.26	Q-1	\$19.4	5.33	4090	166
131	PMP3/4HP	PUMP, 3/4 HP, (INCL. DEMO)	EA.	\$640	\$620.16	Q-1	\$19.4	6.40	3040	166
132	PMP3HP	PUMP, 3 HP	EA.	\$975	\$944.78	Q-1	\$19.4	6.98	4100	166
133	PMP5HP	PUMP, 5 HP	EA.	\$1,150	\$1,114.35	Q-1	\$19.4	8.89	4300	166
134	PMPBRG	PUMP BEARING (INCL. DEMO)	EA.	\$17	\$15.99	Q-1	\$19.4	6.00	Grainger	286
135	PRO	PROFIT			10.00%					
136	PROPGLY	PROPYLENE GLYCOL FLUSH & FILL	GAL.	\$7	\$6.49	1-PLUM	\$21.5	0.14	2100	270



MATERIAL & LABOR COST LOOK UP TABLE

MATERIAL & LABOR COST LOOK UP TABLE										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade					SHEET 5 OF 6			
ENGINEER		E M C Engineers, Inc. Denver, CO					DATE PREPARED 9-May-95			
							PREPARED BY C. Wohliert			
							CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
137	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	\$15	\$14.54	Q-1	\$19.4	10.00	Grainger	2273
138	REHEAT1	REHEAT COIL, 2ROW, 12"x12"	EA.	\$124	\$120.16	Q-5	\$19.4	0.66	3850	246
139	REHEAT1.5	REHEAT COIL, 2ROW, 1.5"x1'	EA.	\$134	\$129.36	Q-5	\$19.4	1.32	3860	246
140	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	\$143	\$138.57	Q-5	\$19.4	1.32	3860	246
141	REHEAT3	REHEAT COIL, 2ROW, 3"x1'	EA.	\$159	\$154.07	Q-5	\$19.4	1.32	3860	246
142	REHEAT4	REHEAT COIL, 2ROW, 3' x 2'	EA.	\$200	\$193.80	Q-5	\$19.4	3.96	3930	246
143	ROFEXH15	ALUMINUM GALV. ROOF INTAKE, 15,000 CFM	EA.	\$2,700	\$2,616.30	Q-9	\$18.7	12.30	5780	289
144	ROFEXH25	ALUMINUM GALV. ROOF INTAKE, 25,000 CFM	EA.	\$4,100	\$3,972.90	Q-9	\$18.7	17.78	5780	289
145	SHUTOFF	CONDENSATE SHUT-OFF CONTROLS	EA.	\$60	\$58.14	1-ELEC	\$20.9	1.00	173	E173
146	STLPIP0.5	STEEL PIPE SCH. 40, 0.5" W/HANGERS	L.F.	\$1	\$1.33	1-PLUM	\$21.5	0.20	560	103
147	STLPIP0.75	STEEL PIPE SCH. 40, 0.75" W/HANGERS	L.F.	\$2	\$1.51	1-PLUM	\$21.5	0.20	570	103
148	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	\$2	\$2.10	Q-1	\$19.4	0.15	580	103
149	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	\$3	\$2.56	Q-1	\$19.4	0.20	590	103
150	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	\$3	\$2.95	Q-1	\$19.4	0.20	600	103
151	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	\$4	\$3.91	Q-1	\$19.4	0.25	610	103
152	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	\$5	\$5.28	Q-15	\$19.4	0.34	2080	104
153	STLPIP3	STEEL PIPE SCH. 40, 3" W/HANGERS	L.F.	\$7	\$6.40	Q-15	\$19.4	0.37	2090	104
154	STLPIP4	STEEL PIPE SCH. 40, 4" W/HANGERS	L.F.	\$9	\$9.16	Q-15	\$19.4	0.43	2110	104
155	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	\$19	\$17.93	Q-16	\$21.7	0.67	2130	104
156	STMBLR1	1,000 MBH STEAM BOILER (Cast Iron)	EA.	\$6,900	\$6,686	Q-7	\$20.6	80.00	2260	172
157	STMCOIL1	36X36 STEAM COIL	EA.	\$510	\$494.19	Q-5	\$19.4	5.93	4660	246
158	STMCOIL2	36X84 STEAM COIL (INCL. DEMO)	EA.	\$925	\$896.33	Q-5	\$19.4	17.91	6260	247
159	UH300	UNIT HEATER, 297 MBH	EA.	\$1,425	\$1,380.83	Q-5	\$19.4	8.00	5140	195
160	UH325	HORIZ. UNIT HEATER, PROPELLER, 133.3 MBH	EA.	\$930	\$901.17	Q-5	\$19.4	3.20	4160	194
161	UH7	HORIZ. UNIT HEATER, PROPELLER, 87.6 MBH	EA.	\$755	\$731.60	Q-5	\$19.4	2.46	4120	194
162	UH9	HORIZ. UNIT HEATER, PROPELLER, 133.3 MBH	EA.	\$930	\$901.17	Q-5	\$19.4	3.20	4160	194
163	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	\$280	\$271.32	1-SHEE	\$20.8	1.13	BARBER	KRUGER
164	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	\$288	\$279.07	1-SHEE	\$20.8	1.22	BARBER	KRUGER
165	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	\$297	\$287.31	1-SHEE	\$20.8	1.33	BARBER	KRUGER
166	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	\$320	\$310.08	1-SHEE	\$20.8	1.48	BARBER	KRUGER
167	VAVBX5	VAV BOX, 500 CFM, ELEC	EA.	\$275	\$266.48	1-SHEE	\$20.8	0.98	BARBER	KRUGER
168	VAVBX70	VAV BOX, 7000 CFM, ELEC	EA.	\$365	\$353.69	1-SHEE	\$20.8	2.60	BARBER	KRUGER
169	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	\$278	\$269.38	1-SHEE	\$20.8	1.00	BARBER	KRUGER
170	VAVCNTL1	VAV BOX CONTROLLER & ACTUATOR, DDC	EA.	\$270	\$261.63	1-ELEC	\$20.9	0.33	BARBER	COLMAN



MATERIAL & LABOR COST LOOK UP TABLE							SHEET	6 OF 6		
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade					DATE PREPARED		9-May-95	
ENGINEER		E M C Engineers, Inc.					PREPARED BY		C. Wohler	
		Denver, CO					CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
171	VAVCNTL2	VAV BOX CONTROLLER & ACTUATOR, ELEC	EA.	\$160	\$155.04	1-ELEC	\$20.9	0.33	BARBER	COLMAN
172	VNTFAN1	6700 CFM UTILITY FAN, V-BELT DRIVE	EA.	\$1,125	\$1,090.13	Q-20	\$19.2	6.67	7820	267
173	VSD10	VARIABLE SPEED DRIVE W/ CONTRLER,10HP	EA.	\$3,300	\$3,197.70	1-ELEC	\$20.9	12.50	PENCE	MEANS
174	VSD15	VARIABLE SPEED DRIVE W/ CONTRLER,15HP	EA.	\$4,190	\$4,060.11	1-ELEC	\$20.9	19.00	PENCE	MEANS
175	VSD20	VARIABLE SPEED DRIVE W/ CONTRLER,20HP	EA.	\$4,999	\$4,844.03	1-ELEC	\$20.9	19.00	PENCE	MEANS
176	VSD25	VARIABLE SPEED DRIVE W/ CONTRLER,25HP	EA.	\$5,600	\$5,426.40	1-ELEC	\$20.9	25.00	PENCE	MEANS
177	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	\$2,310	\$2,238.39	1-ELEC	\$20.9	10.50	PENCE	MEANS
178	VSD5	VARIABLE SPEED DRIVE W/ CONTRLER,5HP	EA.	\$2,523	\$2,444.79	1-ELEC	\$20.9	10.50	PENCE	MEANS
179	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER,7.5HP	EA.	\$2,816	\$2,728.70	1-ELEC	\$20.9	12.50	PENCE	MEANS
180	WAC0.5	WINDOW AIR CONDITIONER, 1/2 TON	EA.	\$390	\$377.91	1-CARP	\$18.3	1.00	4340	243
181	WAC1	WINDOW AIR CONDITIONER, 1 TON	EA.	\$550	\$532.95	L-2	\$16.1	2.00	4340	243
182	WAC1.5	WINDOW AIR CONDITIONER, 1.5 TON	EA.	\$775	\$750.98	L-2	\$16.1	2.67	4780	243
183	WCHLR1	20 TON WATER CHILLER, RECIP., AIR COOLED	EA.	\$11,500	\$11,144	Q-7	\$20.6	91.43	500	241
184	WIRE#12	COPPER WIRING #12	C.L.F.	\$8	\$7.41	1-ELEC	\$20.9	0.73	100	E122
185	WIRE#6	COPPER WIRING #6	C.L.F.	\$26	\$24.71	1-ELEC	\$20.9	1.23	160	E122



LABOR COST LOOK UP TABLE			SHEET	1	OF	1
PROJECT Fort Riley Feasibility Study for HVAC Upgrade			DATE PREPARED 15-Mar-95			
ENGINEER E M C Engineers, Inc. Denver, CO			PREPARED BY C. Wohler			
			CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Average Cost \$/hr	Location Adj. Cost 0.761	"Means" Page No.	
1	1-CARP	CARPENTER	\$24.00	\$18.26	432	
2	1-CLAB	LABORERS	\$19.00	\$14.46	434	
3	1-ELEC	ELECTRICIAN	\$27.50	\$20.93	E386	
4	1-PLUM	PLUMBER	\$28.30	\$21.54	433	
5	1-SHEE	SHEET METAL WORKER	\$27.35	\$20.81	434	
6	1-STPI	STEAMFITTER, PIPEFITTER	\$28.30	\$21.54	434	
7	2-ELEC	TWO ELECTRICIANS	\$55.00	\$41.86	E386	
8	L-2	CARPENTER & HELPER	\$21.20	\$16.13	433	
9	Q-1	PLUMPER & APPRENTICE	\$25.48	\$19.39	433	
10	Q-10	SHEET METAL CREW	\$25.53	\$19.43	434	
11	Q-14	INSULATION CREW	\$24.20	\$18.42	434	
12	Q-15	PLUMBING CREW	\$25.48	\$19.39	434	
13	Q-16	PLUMBING CREW	\$28.55	\$21.73	434	
14	Q-20	SHEET METAL CREW W/ ELECTRICAL HELP	\$25.20	\$19.18	434	
15	Q-5	STEAM FITTER	\$25.48	\$19.39	434	
16	Q-6	STEAM FITTER CREW	\$26.42	\$20.11	434	
17	Q-7	STEAM FITTER CREW	\$27.01	\$20.55	434	
18	Q-9	SHEET METAL CREW	\$24.63	\$18.74	434	
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						



MAINTENANCE COSTS ASSUMPTIONS

Preventative Maintenance

The following are assumptions made for preventative maintenance labor hours for typical HVAC equipment. The preventative maintenance hours include inspections, maintenance, and breakdown repairs. A yearly maintenance routine of monthly, quarterly, semi-annually, and annual inspections were assumed.

- Air Handling Units > 5,000 cfm are maintained:
 - 1 hour on monthly inspections (for 12 months) = 12 hrs/yr
 - 2 hours on quarterly inspections = 8 hrs/yr
 - 2 hours on semi-annual inspections = 4 hrs/yr
 - 1 hour on annual inspections = 1 hr/yr

Total for Maintenance Labor Hours = 25 hrs/yr

- Air Handling Units <= 5,000 cfm are maintained:
 - 1 hour on monthly inspections (for 12 months) = 12 hrs/yr
 - 1 hours on quarterly inspections = 4 hrs/yr
 - 1 hours on semi-annual inspections = 2 hrs/yr
 - 1 hour on annual inspections = 1 hr/yr

Total for Maintenance Labor Hours = 19 hrs/yr

- Boilers > 2.5 MBH are maintained:
 - 1 hour on monthly inspections (for 7 months) = 7 hrs/yr
 - 1 hour on quarterly inspections = 2 hrs/yr
 - 16 hours on annual inspections = 16 hr/yr

(Includes cleaning and chemical treatment;
Chemicals estimated at \$100)

Total for Maintenance Labor Hours = 25 hrs/yr

- Boilers < 2.5 MBH are maintained:

- 1 hour on monthly inspections (for 7 months) = 7 hrs/yr
- 1 hour on quarterly inspections = 2 hrs/yr
- 8 hours on annual inspections = 8 hr/yr
(Includes cleaning and chemical treatment;
Chemicals estimated at \$50)

Total for Maintenance Labor Hours = 17 hrs/yr

- Existing Cooling Towers < 20 Tons are maintained:

- 1 hour on monthly inspections (for 5 months) = 5 hrs/yr
- 10 hours on annual inspections = 10 hr/yr
(Includes cleaning and chemical treatment;
Chemicals estimated at \$50)

Total for Maintenance Labor Hours = 15 hrs/yr

- Chiller with Air Cooled Condenser < or = 20 Tons are maintained:

- 1 hour on monthly inspections (for 5 months) = 5 hrs/yr
- 5 hours on annual inspections = 10 hr/yr

Total for Maintenance Labor Hours = 15 hrs/yr

- Small HVAC equipment such as Fan Coils, Unit Heaters, Infrared Heaters, and Furnace Air Conditioners are maintained:

- 1 hours on quarterly inspections = 4 hrs/yr

Total for Maintenance Labor Hours = 4 hrs/yr

MEMORANDUM

TO: MR. ALLEN NIEMEYER
EMC ENGINEERS

FROM: RALPH PENCE

DATE: FEBRUARY 22, 1995

SUBJECT: ABB VARIABLE SPEED DRIVES
BUDGET PRICING - VARIABLE TORQUE APPLICATIONS

Allen,

Per your recent request, listed below please find List Pricing for ABB's ACH-500 series. The ACH-500 series is specifically designed for the HVAC industry, and comes standard with an H-O-A switch and manual speed pot. ACH specifications and standard features are also included for your review.

<u>HP</u>	<u>ABB MODEL #</u>	<u>VFD</u>	<u>ADD BY-PASS (OPTIONAL)</u>
3	ACH501-003-4-00P2	\$2110.00	\$1918.00
5	ACH501-005-4-00P2	2323.00	1981.00
7 1/2	ACH501-007-4-00P2	2616.00	2023.00
10	ACH501-010-4-00P2	3100.00	2090.00
15	ACH501-015-4-00P2	3990.00	2158.00
20	ACH501-020-4-00P2	4799.00	2298.00

The optional by-pass package includes:

- Extended enclosure (NEMA 1)
- Door Interlocked disconnect switch
- Motor overload relay
- 3-contactor by pass
- By-pass switch and service switch
- H-O-A switch and speed pot
- Customer safety circuit terminal strip
- 115 VAC control power transformer
- 3 pilot lights

Page 2
February 22, 1995
Mr. Allen Niemeyer

Please remember these are list prices and allow margins for distribution and contractor mark-up.

Thank you for your interest in ABB drives.

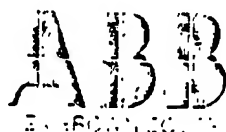
Sincerely,

A handwritten signature in black ink, appearing to read "Ralph Pence", with a stylized flourish at the end.

Ralph Pence

RP:bel

cc: Ed Hoover



AC DRIVES ACH 500

3-350 HP @ 480 V
2-25 HP @ 230 V
Variable Torque

DESCRIPTION

The ACH 500 series is a microprocessor based Pulse Width Modulated (PWM) adjustable frequency AC drive. The ACH 500 drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for varied HVAC applications.

With drives ranging from 2 to 350 HP, the ACH 500 series features a universal alphanumeric interface that "speaks" to the operator in plain English phrases, greatly simplifying set-up, operation, and fault diagnosis.

Each ACH 500 drive comes equipped with three pre-programmed application macros, which at a touch of a button, allow rapid configura-



tion of inputs, outputs, and performance parameters for fan and pump applications to maximize convenience and minimize start-up time.

The ACH 500 series can handle the most demanding of HVAC applications in an efficient, dependable, and economic manner.

STANDARD FEATURES

- UL Listed
- 40 Character Multi-lingual Alphanumeric Display For:
 - Output Frequency
 - Motor Speed (RPM, %, or user programmable)
 - Motor Current
 - Calculated Motor Torque
 - Calculated Motor Power
 - DC Bus Voltage
 - Output Voltage
 - Heatsink Temperature
 - Elapsed Time Meter
 - kWh Meter
 - Parameter Set-Up
 - Fault Text
 - Warning Text
 - Supervision Text
- RS-485 Communications
- Three position Hand-Off-Auto switch w/Speed Potentiometer
- Two (2) Analog Inputs
- Six (6) Programmable Digital Inputs
- Two (2) Programmable Analog Outputs
- Three (3) Programmable Digital Relay Outputs
- Adjustable Filters On Analog Inputs and Outputs
- Input Speed Signals:
 - Current 0(4)-20 mA
 - Voltage 0(2)-10 VDC
 - Accel/Decel Contacts
 - RS-485 Communications
- Start/Stop:
 - 2 Wire (Dry Contact Closure)
 - 3 Wire (Momentary Contacts)
 - Application Of Input Power
- All Control Inputs Isolated From Ground and Power
- Protection Circuits:
 - Over Current
 - Ground Fault
 - Over Voltage
 - Under Voltage
 - Over Temperature
 - Adaptable Electronic Motor Overload (I²t)
- Programmable Maximum Frequency To 500 Hz (ACH 501)

- PI Setpoint Controller
- Seven (7) Preset Speeds
- Five (5) Critical Frequency Lockout Points
- Automatic Extended Power Loss Ride-Through
- Three (3) Current Limit Circuits
- Automatic Electronic Reverse
- Quick Reverse
- DC Injection Braking
- DC Hold
- Auto Restart-Customer Selectable and Adjustable
- Input Fuses
- Two (2) Independently Adjustable Accel and Decel Ramp
- Linear Or "S" Curve Accel/Decel Ramps
- Ramp Or Coast To A Stop
- V/Hz Shape:
 - Linear
 - Squared
 - Automatic
- Start Functions:
 - Ramp
 - Flying Start
 - Automatic Torque Boost
- Automatic Slip Compensation
- IR Compensation
- DC Line Reactor

OPTIONAL FEATURES

- Disconnect Switch
- Circuit Breaker
- Manual Bypass
- Automatic Bypass
- Service Switch
- Motor Overload Relays
- Analog Meters



AC DRIVES ACH 500

SPECIFICATIONS

Input Connection

Voltage (V_N)	3 phase, 440/460/480/500 +/- 10% permitted tolerance
Frequency	3 phase, 208/220/230/240 +/- 10% permitted tolerance
Power factor: For fundamental	48 ... 63 Hz ~ 0.98

Motor Connection

Output voltage:	3 ϕ 0 to V_N (V_{max} at field weakening point)
Output frequency:	0 to 500 Hz (ACH 501), 0 to 120 Hz (ACH 502)
Frequency resolution:	0.01 Hz Digital
	12 BIT - analog input 2
	10 BIT - analog input 1
Switching frequency (f_s)	1.0 to 12.0 kHz (ACH 501) 3.0 kHz (ACH 502)
Continuous output current:	Rated I_{RSC} (Nominal rated current, Variable Torque)
Overload Capacity:	110% of I_{RSC} for 1 min every 10 min
Starting duty:	140% of I_{RSC} for 2 sec every 15 sec
Field weakening point:	30 to 500 Hz (ACH 501), 30 to 180 Hz (ACH 502)
Acceleration time:	0.1 to 1800 sec
Deceleration time:	0.1 to 1800 sec
Enclosure:	NEMA 1
Environmental limits:	
Ambient operating temperature ($f_s=3kHz$)	32 to 104°F (0 to 40°C) NEMA 1
Storage temperature:	-40 to +158°F (-40 to +70°C)
Cooling method:	Integral fan(s)
Relative humidity:	max 95%, no condensation allowed
Altitude: max	3300 ft. (1000 m) above sea level (100% load) 1% derating every 330 ft. above 3300 ft.

External Control Connections

Two programmable Analog Inputs:	
Voltage reference:	0 to 10 V, 200k ohm single ended
Current reference:	0 to 20 mA, 250 ohms single ended
Potentiometer	10 V 10 mA (1K to 10K ohms)
Auxiliary voltage:	+24 VDC, max 200 mA
Six Programmable Digital Inputs	24 VDC
Two Programmable Analog Outputs:	0 (4) to 20 mA, 500 ohm
Three Programmable Relay (Form C) Outputs:	
Max switching voltage	300 VDC/250 VAC
Max switching current	8 A/24 VDC, 0.4 A/250 VDC
Max switching power	2000 VA/250 VAC
Max continuous current	2A
Protections:	
Overcurrent trip limit:	315% instantaneous, 225% (RMS)
Slow current regulation limit:	125%
Rapid current regulation limit:	170%
Current switch-off limit:	255% instantaneous, 175% (RMS)
Overvoltage trip limit:	130%
Undervoltage trip limit:	65%
Overtemperature limit (heatsink):	+158°F (+70°C) ACH 501, +185°F (+85°C) ACH 502
Auxiliary voltage:	Short Circuit Protected
Ground fault:	Running (ACH 501); At Start (ACH 502)
Microprocessor fault:	Protected
Motor stall protection	Protected
Motor overtemperature protection (I^2t)	Protected
AC Line Fuses	Standard

Specifications are subject to change without notice. Consult factory when specifications are critical.

LMHS

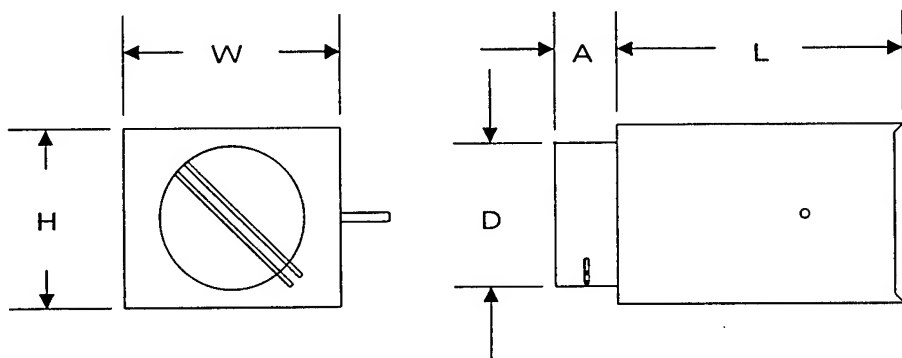
Single Duct VAV Terminal Unit

Inlet Size	Maximum CFM	D	A	H	W	L
1 4	235	3 ⁷ / ₈	5 ³ / ₈	8	12	15 ¹ / ₂
2 5	375	4 ⁷ / ₈	5 ³ / ₈	8	12	15 ¹ / ₂
3 6	530	5 ⁷ / ₈	3 ³ / ₈	8	12	15 ¹ / ₂
7	730	6 ⁷ / ₈	3 ³ / ₈	10	12	15 ¹ / ₂
8	945	7 ⁷ / ₈	3 ³ / ₈	10	12	15 ¹ / ₂
9	1200	8 ⁷ / ₈	3 ³ / ₈	12 ¹ / ₂	14	15 ¹ / ₂
10	1450	9 ⁷ / ₈	3 ³ / ₈	12 ¹ / ₂	14	15 ¹ / ₂
12	2150	11 ⁷ / ₈	3 ³ / ₈	15	16	15 ¹ / ₂
14	2950	13 ⁷ / ₈	3 ³ / ₈	17 ¹ / ₂	20	15 ¹ / ₂
16	3800	15 ⁷ / ₈	3 ³ / ₈	18	24	15 ¹ / ₂
20	7250	23 ⁷ / ₈ x 15 ⁷ / ₈	3 ¹¹ / ₁₆	18	38	15

Notes:

1. Unit shown is standard LMHS unit, which includes thermal/acoustical lining, heavy gauge construction, low leakage gasketed damper, Krueger linear flow probe with balancing taps.
2. Maximum and minimum controllable air volumes are listed on page 5.
3. 22 ga. construction is standard; 20 ga. is optional.

Diag.



LMHS

Single Duct VAV Terminal Unit
Recommended Unit Capacities

Use the chart below as a guide for selecting the correct LMHS unit size.

	LMHS		LMHS		ALMHS		DLMHS	
Control type	pneumatic		pneumatic		analog electronic		digital	
Control code	20		60		B		specify DDC vendor	
Unit Size	min.	max.	min.	max.	min.	max.	min.	max.
4	55-175	80-225	45-175	80-225	45-225	45-225	45-175	45-225
5	85-270	120-350	65-270	120-350	65-350	65-350	65-270	65-350
6	105-330	150-450	85-330	150-450	85-450	85-450	85-330	85-450
7	135-425	190-600	105-425	190-600	110-600	110-600	105-425	100-600
8	190-600	265-850	145-600	265-850	140-850	140-850	145-600	265-850
9	225-700	315-1050	175-700	315-1050	170-1050	170-1050	175-700	315-1050
10	300-925	415-1350	230-925	415-1350	240-1350	240-1350	230-925	415-1350
12	420-1330	600-2000	450-1330	600-2000	330-2000	330-2000	450-1330	600-2000
14	575-1800	810-2700	575-1800	810-2700	330-3200	330-3200	575-1800	810-2700
16	750-2400	1060-3500	580-2400	1060-3500	440-4000	440-4000	580-2400	1060-3500
24 x 16	1950-6200	2800-8000	1600-6200	2800-8000	n/a	n/a	1600-6200	2800-8000
Notes	1, 2, 3		1, 2, 3					

	ELMHS		ELMHS	
Control type	electric		electric	
Control code	A		L	
Unit Size	range	range	range	range
4	0	n/a	0	0-225
5	0	n/a	0	0-350
6	0	n/a	0	0-450
7	0	n/a	0	0-600
8	0	n/a	0	0-850
9	0	n/a	0	0-1050
10	0	n/a	0	0-1350
12	0	n/a	0	0-2000
14	0	n/a	0	0-2700
16	0	n/a	0	0-3500
24 x 16	0	n/a	0	0-8000
Notes	4	4	5	5

EXAMPLE: A zone exists requiring VAV control of a zone. The maximum flow is to be 500 CFM, the minimum is to be 175, based on reheat requirements. The control will be analog electronic.

Use Table 1 above to select a size 8. Note that the size 7 or 9 will also be capable of controlling the required amount.

Notes:

1. CFM ranges are factory set on all pressure independent pneumatic and analog control schemes.
2. Factory set minimum CFMs are based on controllers ability to accurately maintain flow setting. Factory will not set controls outside the ranges indicated. Settings below indicated range will control less accurately.
3. Minimum CFM settings can be set low as 0 CFM; however, ventilation requirements can be met by setting a minimum greater than zero. Krueger recommends a minimum setpoint equal to 25% of the maximum setting.

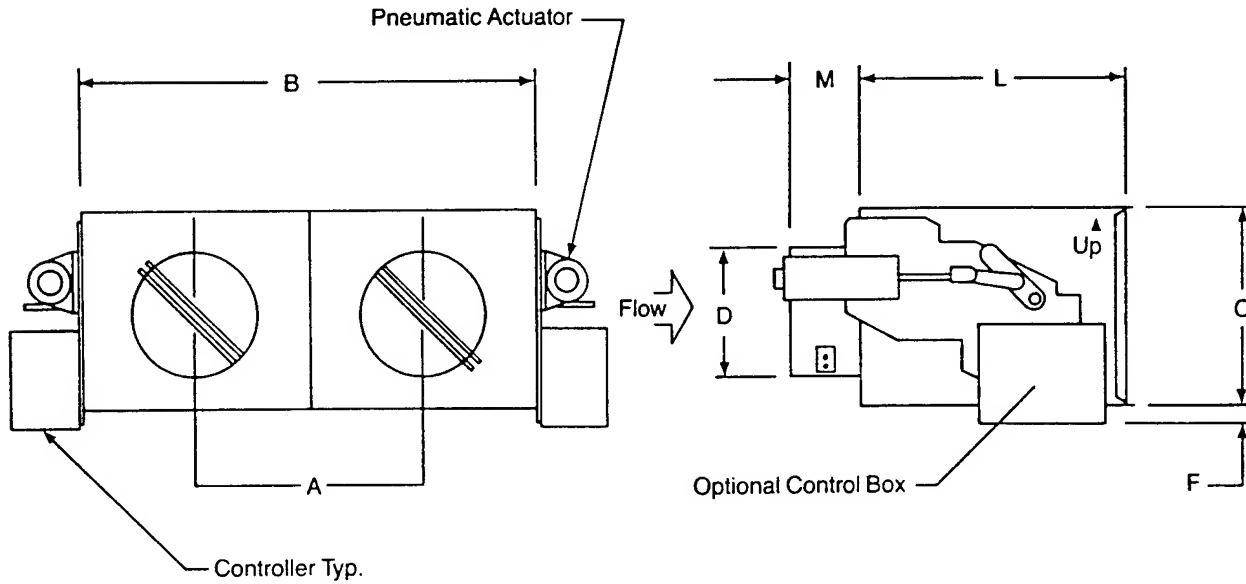
Notes:

4. Code A electric controls are pressure dependent, and do not have the ability to control CFM settings. The minimum setting, therefore, is always zero. A set maximum flow rate is not possible.
5. Code L electric controls are pressure dependent, and maximum limiting, and do not have the ability to control minimum CFM settings. The minimum setting, therefore, is always zero.
6. The maximum flow rate is controlled by an adjustable airflow switch.

Dimensions

LMHD

Dual duct VAV terminal unit



LMHD

Inlet Size	CFM Range	A	B	C	D	F	L	M
4	0-255	12 $\frac{1}{8}$	24 $\frac{1}{8}$	8	3 $\frac{1}{8}$	4 $\frac{1}{8}$	15 $\frac{1}{2}$	5 $\frac{1}{8}$
5	0-350	12 $\frac{1}{8}$	24 $\frac{1}{8}$	8	4 $\frac{1}{8}$	4 $\frac{1}{8}$	15 $\frac{1}{2}$	5 $\frac{1}{8}$
6	0-450	12 $\frac{1}{8}$	24 $\frac{1}{8}$	8	5 $\frac{1}{8}$	4 $\frac{1}{8}$	15 $\frac{1}{2}$	3 $\frac{3}{8}$
7	0-650	12 $\frac{1}{8}$	24 $\frac{1}{8}$	10	6 $\frac{1}{8}$	3 $\frac{1}{8}$	15 $\frac{1}{2}$	3 $\frac{3}{8}$
8	0-800	12 $\frac{1}{8}$	24 $\frac{1}{8}$	10	7 $\frac{1}{8}$	3 $\frac{1}{8}$	15 $\frac{1}{2}$	3 $\frac{3}{8}$
9	0-1050	14 $\frac{1}{8}$	28 $\frac{1}{8}$	12 $\frac{1}{2}$	8 $\frac{1}{8}$	2 $\frac{3}{8}$	15 $\frac{1}{2}$	3 $\frac{3}{8}$
10	0-1350	14 $\frac{1}{8}$	28 $\frac{1}{8}$	12 $\frac{1}{2}$	9 $\frac{1}{8}$	2 $\frac{3}{8}$	15 $\frac{1}{2}$	3 $\frac{3}{8}$
12	0-2100	16 $\frac{1}{8}$	32 $\frac{1}{8}$	15	11 $\frac{1}{8}$	1 $\frac{1}{8}$	15 $\frac{1}{2}$	3 $\frac{3}{8}$
14	0-3200	20 $\frac{1}{8}$	40 $\frac{1}{8}$	17 $\frac{1}{2}$	13 $\frac{1}{8}$	$\frac{3}{8}$	15 $\frac{1}{2}$	3 $\frac{3}{8}$
16	0-4000	24 $\frac{1}{8}$	48 $\frac{1}{8}$	18	15 $\frac{1}{8}$	N A	15 $\frac{1}{2}$	3 $\frac{3}{8}$

1. See LMHDT if integral mixer is required.
2. See Krueger Submittal Sheets for more information and dimensions on other control sequences.

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd. 9755 Dogwood Rd.
Suite C-200 Suite 220
Denver, CO 80227 Roswell, GA 30075
(303) 988-2951 (404) 642-1864

JOB HVAC Upgrade - FTRiley, KS.

SHEET NO. _____

OF _____

CALCULATED BY C. WohlerDATE 2/22/95

CHECKED BY _____

DATE _____

SCALE _____

LMHS VAV Terminal Units.Long + AssociatedTom HartnerSingle Duct VAV Terminal unitLMHS Series

<u>VV</u>	<u>Box inlet</u>	<u>CFM</u>	<u>COST Per Box w/out controls/sensors</u>
2	4		\$65
3	6 →	500 cfm	↓
4	8 →	950 cfm	\$65
5	9		\$68
6	10		\$71
7	12 →	2150 cfm	\$78

for pressure independent
Pneumatic operator sense
+ controls

add ~\$45/Box

for DDC
add ~\$300/Box

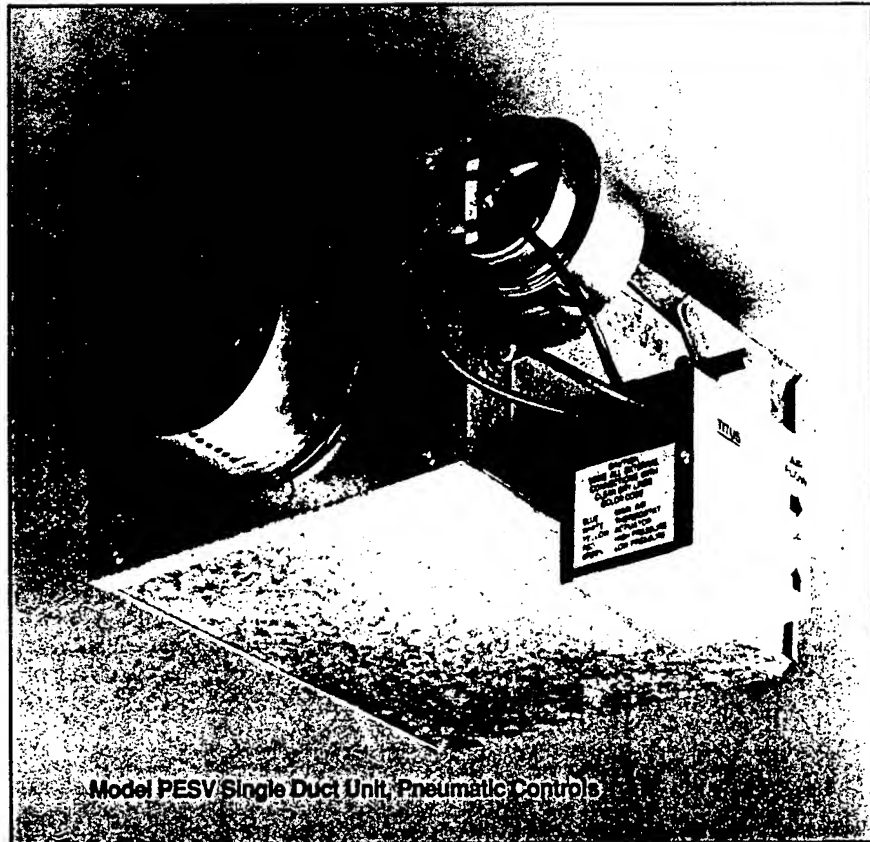
An Overview of VAV Terminals

Single Duct

TITUS single duct, variable volume terminal units can be selected for cooling only, cooling with reheat, heating only, or cooling-and-heating applications.

Controls available are:

- ▶ Pneumatic, pressure independent and pressure dependent.
- ▶ Analog electronic, pressure independent.
- ▶ Direct digital electronic, pressure independent.
- ▶ Electric, pressure dependent.



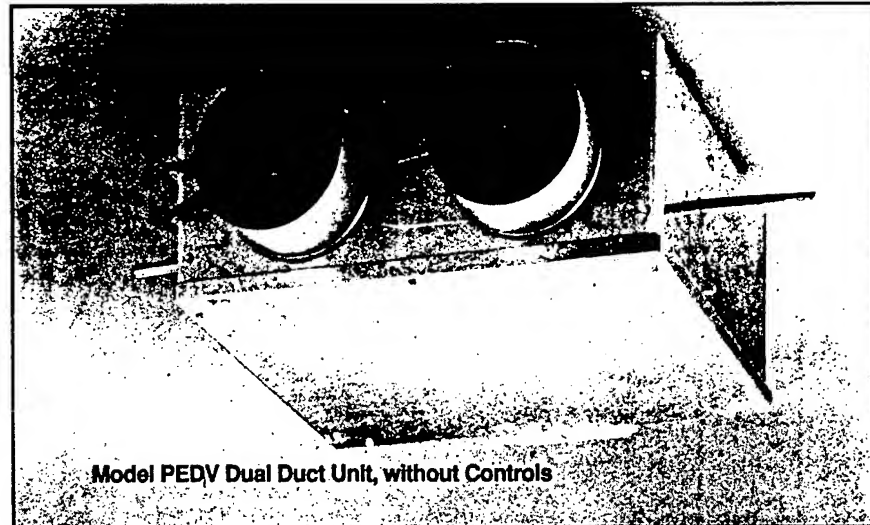
Model PESV Single Duct Unit, Pneumatic Controls

Dual Duct

TITUS dual duct, variable volume terminal units supply both hot and cold air in a variety of control sequences. Models are available for constant volume mixing of hot and cold air, as well as for non-mixing applications.

Controls available are:

- ▶ Pneumatic, pressure independent.
- ▶ Direct digital electronic, pressure independent.



Model PEDV Dual Duct Unit, without Controls

The Basic Terminal Unit

Low-Leakage Casing

Inlet Size	Leakage, CFM	
	0.5"ΔP _s	1.5"ΔP _s
4, 5, 6	1.5	3
7, 8	1.5	3
9, 10	2	4
12	3	5
14	4	6
16	5	7

Values for single duct unit or one side of Model EDV dual duct unit.

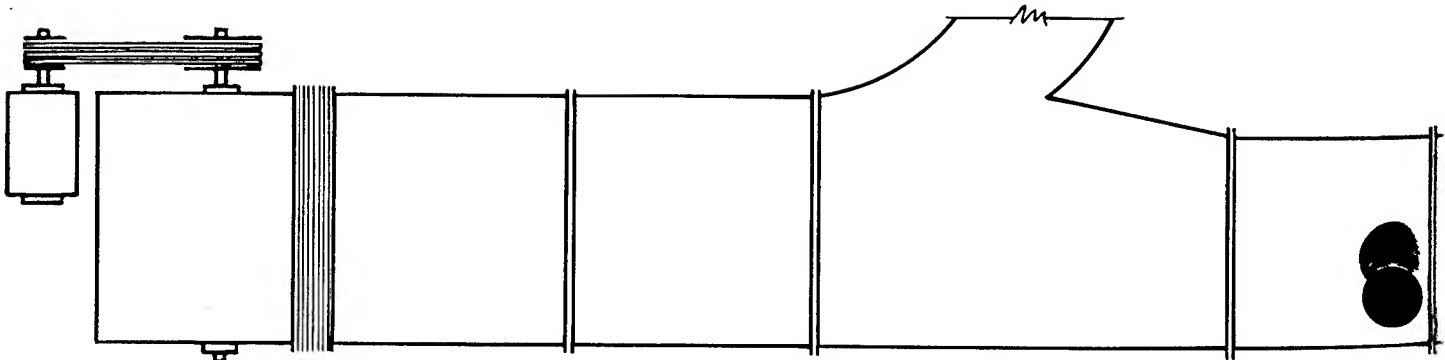
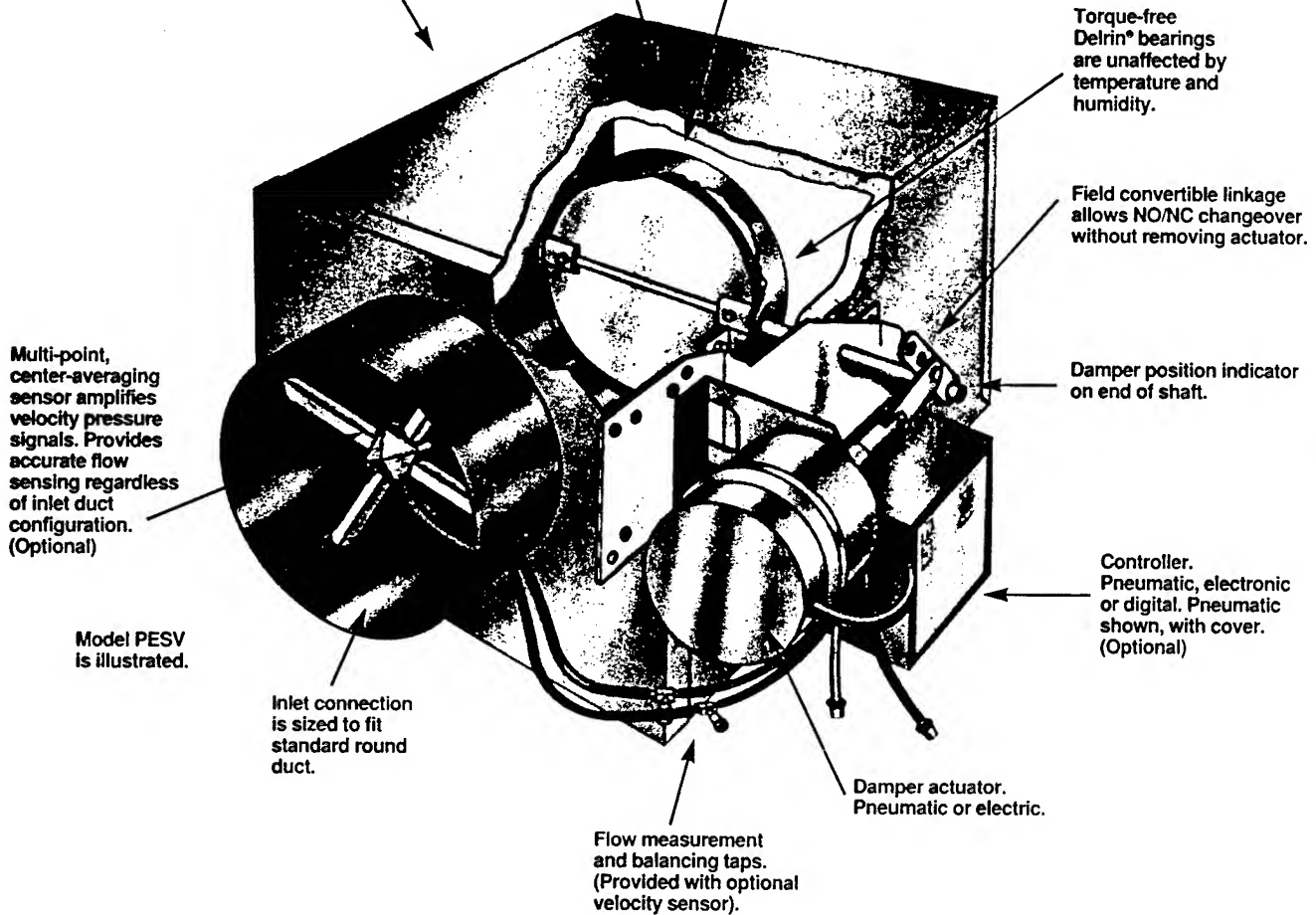
Standard insulation is dual density, coated to resist air erosion. Meets requirements of NFPA 90A and UL 181.

TITUS damper design for low pressure drop and discharge sound power level.

Tight Close-Off Damper

Inlet Size	Leakage, CFM		
	1.5"ΔP _s	3.0"ΔP _s	6.0"ΔP _s
4, 5, 6	4	5	7
7, 8	4	5	7
9, 10	4	5	7
12	4	5	7
14	4	6	8
16	5	7	9

Values for single duct unit or one side of Model EDV dual duct unit.



Single/Dual Duct Terminals ► G4

Benefits to the

Owner, Architect, Engineer, Installer, Balancer

The TITUS single or dual duct terminal unit is the basic module for a variable air volume (VAV) system. It precisely regulates the flow of air to a room or zone in response to a room thermostat or other signaling device.

The building owner benefits from low utility bills, as well as from a high level of occupant comfort. This is because the TITUS terminal unit controls air flow accurately at low duct pressures, with correspondingly low fan horsepowers.

The table below illustrates the amount of energy savings that can be expected.

Annual Power Cost/1000 cfm @ 6¢/kWh

Total Pressure	Fan Total Efficiency		
	75%	80%	90%
5	\$410	\$363	\$341
4	328	291	273
3	246	218	205
2	164	145	136
1	82	72	68
0.5	41	36	34
0.4	33	22	27
0.3	25	22	20

Example: A fan handles 30,000 cfm at 2" total pressure, with a total efficiency of 75%. What is the annual saving in energy cost if the total pressure is reduced to 0.5"? From the table, $30 \times (\$164 - \$41) = \$3690$ per year.

Extremely low air leakage from the TITUS terminal units further reduces energy costs to the owner while boosting performance gains. (See the leakage table on the facing page.)

For example: A TITUS 10", 1350 cfm unit operating at 1.5" sp downstream has a casing leakage of only four cfm, or less than three tenths of 1%.

For an added benefit, the tight close-off damper in the same 10" unit allows only four cfm of leakage at 1.5" ΔP_s .

The architect can concentrate on design and use of space rather than mechanical restrictions because TITUS terminal units are compact and easily accessible for servicing. Several choices of coil sections, attenuators, and multiple outlets add flexibility.

The engineer, by specifying the TITUS terminal unit, is assured of accurate performance ratings and stable, repeatable cfm settings. The many configurations, accessories, and controls give the engineer considerable scope for problem solving and cost effective innovation.

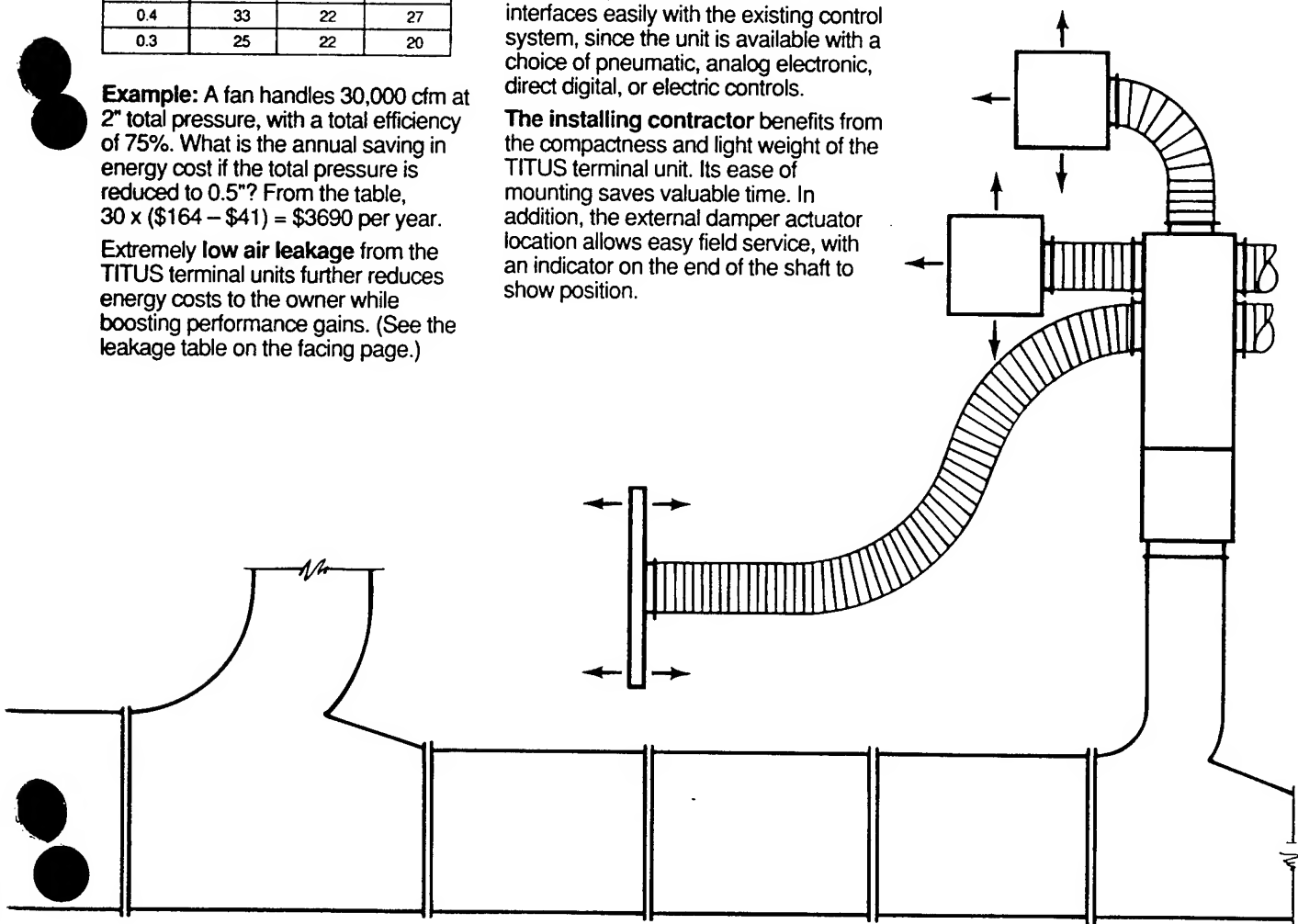
Where an existing building is to be retrofitted, the TITUS terminal unit interfaces easily with the existing control system, since the unit is available with a choice of pneumatic, analog electronic, direct digital, or electric controls.

The installing contractor benefits from the compactness and light weight of the TITUS terminal unit. Its ease of mounting saves valuable time. In addition, the external damper actuator location allows easy field service, with an indicator on the end of the shaft to show position.

The balancing contractor can work faster because the TITUS terminal unit is an accurate flow measuring station. Convenient gauge taps or meter terminals (depending on the type of control) are built in.

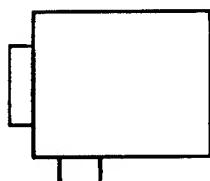
Choose from these basic control types and unit configurations:

- Single Duct – Dual Duct
- Fan powered, constant volume
- Fan powered, variable volume
- Retrofit
- Pneumatic – Electronic – Electric
- Direct Digital

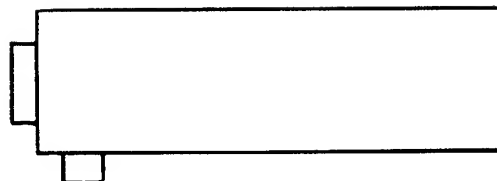


TITUS® Single/Dual Duct Terminals ► Design Features

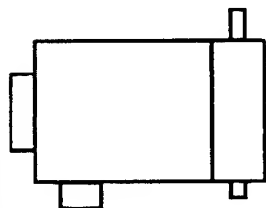
Select a basic terminal unit,
add accessory modules to suit the system design.



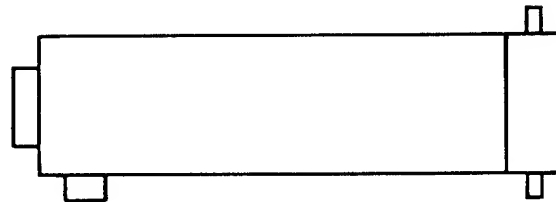
Basic Unit



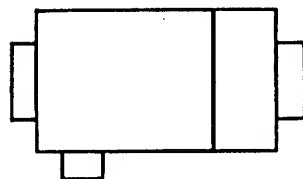
Basic Unit with
Integral Attenuator



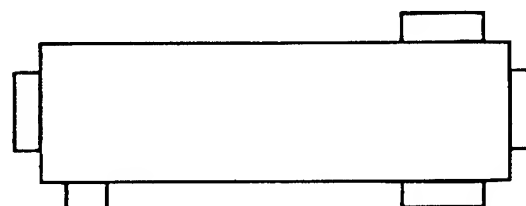
Basic Unit with
Water Coil



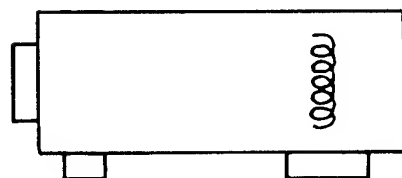
Basic Unit with
Integral Attenuator and Water Coil



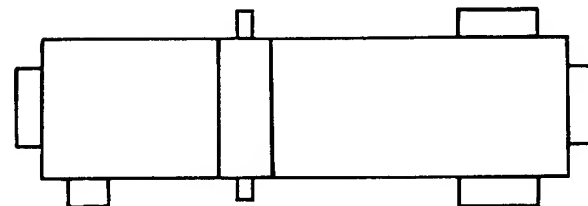
Basic Unit with
Round Discharge



Basic Unit with
Integral Multi-Outlet



Basic Unit with
Electric Coil*



Basic Unit with
Water Coil and Multi-Outlet

Single/Dual Duct Terminals ► G6

*Electric coil not available with ESV pressure dependent terminals.

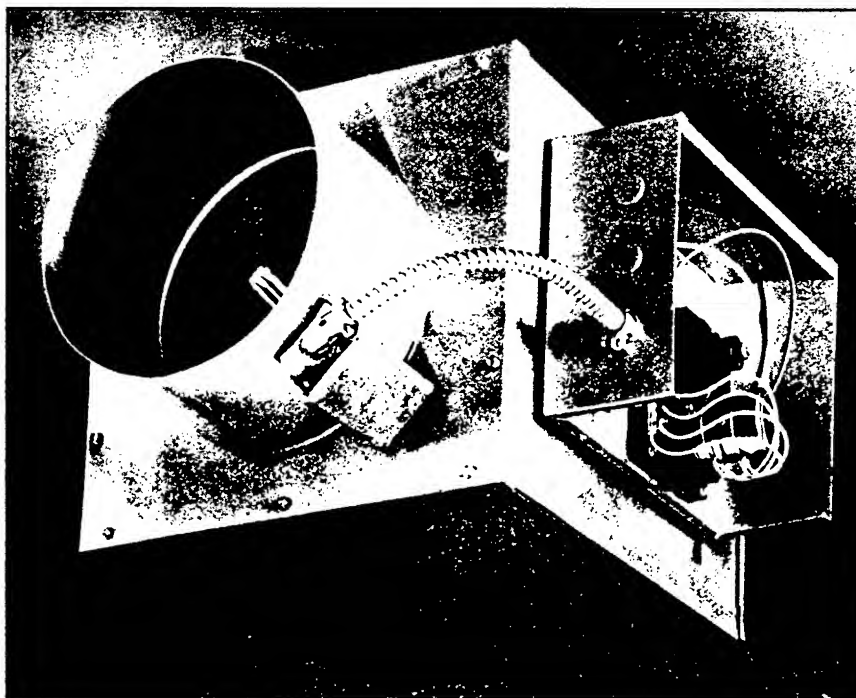
Analog Electronic Units ■ Pressure Independent

Model: AESV

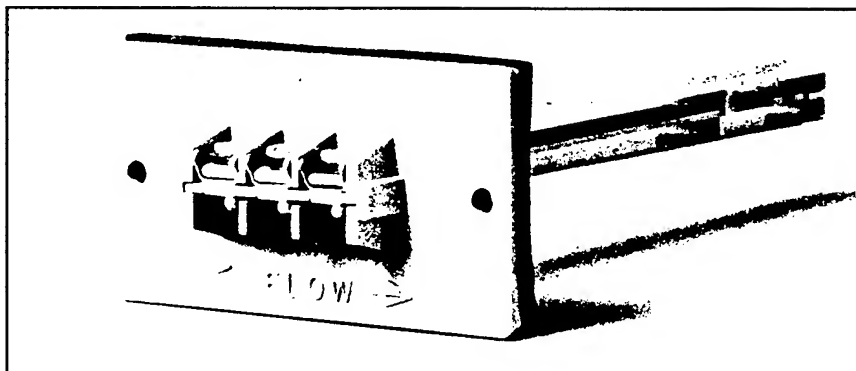
The TITUS Model AESV controls air flow electronically at any duct pressure or temperature that can be expected in a commercial variable air volume system.

The standard electronic velocity sensor, mounted in the inlet of the terminal, is temperature compensated so that there is no difference in calibration over the entire heating and cooling range. The sensor measures only velocity, therefore control of air flow is as accurate at 0.03" of static pressure as at 6".

The optional air flow transducer allows the use of the TITUS multi-point averaging velocity sensor, which averages sampled velocities across the entire terminal inlet. This ensures an accurate velocity signal to the controller even with less than ideal inlet conditions. The transducer is completely solid state with a temperature compensating bridge, and is unaffected by changes in ambient air temperature, inlet air temperature, or position.



Model AESV is shown with control box cover removed.



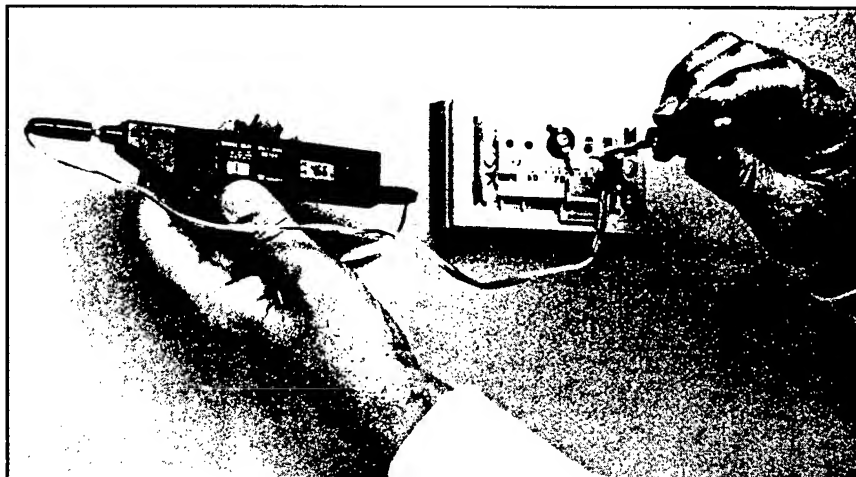
Electronic velocity sensor is temperature compensated.

Air flow rate is adjustable at the room thermostat on the wall.

With the AESV, it is not necessary to climb up into the ceiling space to read and adjust the controller set points. This is accomplished right at the electronic thermostat. Removing the thermostat cover gives access to the adjusting screws and voltmeter jacks.

The electronic thermostat furnished with the unit is one of four types, depending on the application: cooling; heating; cooling with reheat; and cooling-heating. Where required, a 3-stage reheat or automatic changeover relay is factory installed and wired in the control box of the unit.

For a more detailed description of TITUS electronic thermostats, please see pages G16 and G17.



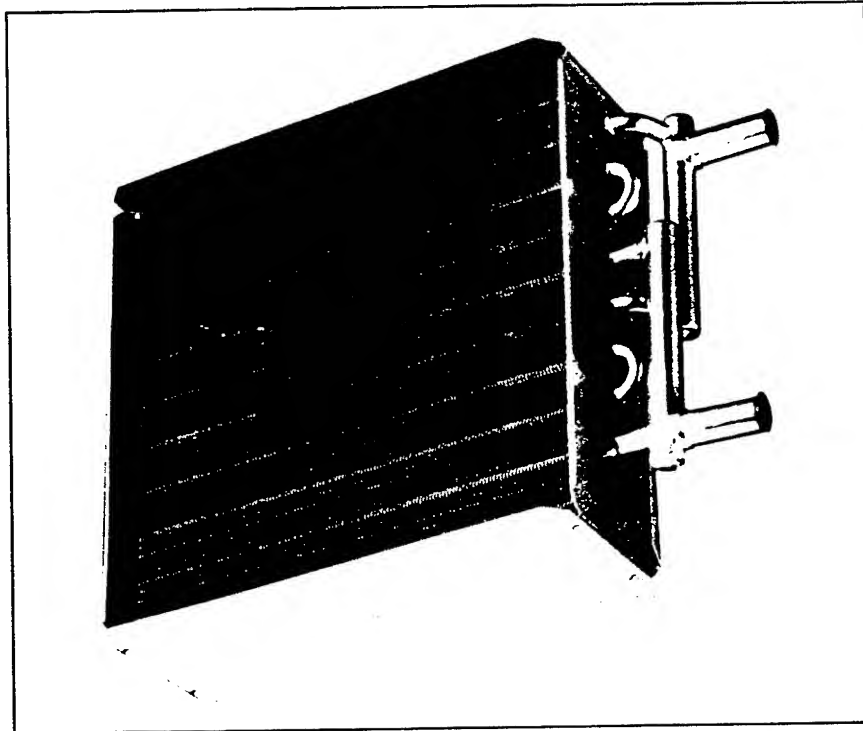
Electronic thermostat has cfm adjustments and voltmeter jacks.

Hot Water and Electric Coils for Single Duct Units

Hot Water Coil

The hot water coil is enclosed in a galvanized steel casing module to match the basic terminal unit. It is factory installed on the terminal discharge as shown on page G6.

- ▶ Optional on all models of TITUS single duct terminals.
- ▶ Tubes are 1/2" OD copper.
- ▶ Connections: Single circuit is 1/2" OD male solder. Multiple circuit is 7/8" OD male solder.
- ▶ Fins are aluminum, rippled, ten per inch.
- ▶ Casing is galvanized steel.
- ▶ Downstream duct connection is slip and drive cleat.
- ▶ For capacities, see pages G33-G36.
- ▶ For dimensions, see page G24.
- ▶ Water coil valves—pneumatic and electronic are available from TITUS.



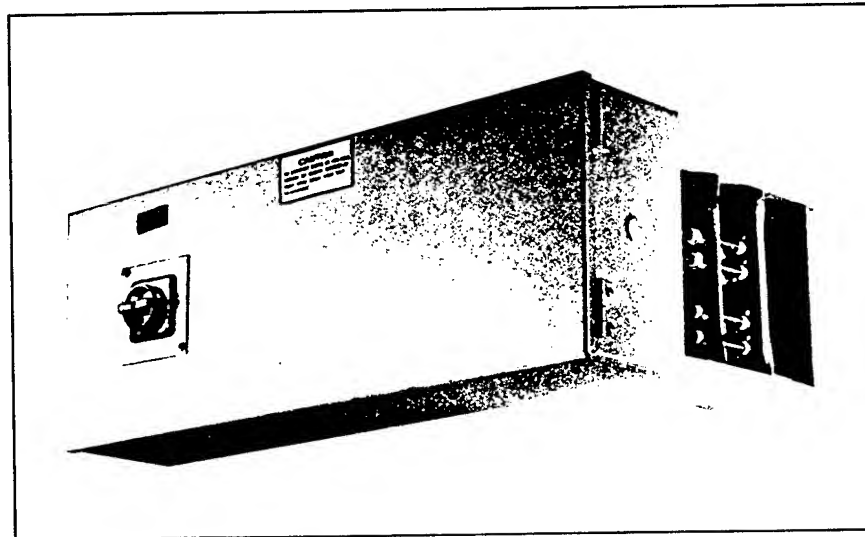
Electric Coil

TITUS electric heating coils are designed specifically for use with variable air volume terminals. They are furnished factory mounted in an integral sound attenuator.

- ▶ Furnished with TITUS Model PESV, AESV, and DESV pressure independent units. Not furnished with pressure dependent units.
- ▶ Elements are high grade nickel chrome.
- ▶ 1, 2, or 3 steps of control.
- ▶ Current characteristics available: 208/240/277 volt, 1 phase, 60 Hertz and 208 or 480 volt, 3 phase, 60 Hertz.
- ▶ Ratings, dimensions, and additional features, see page G37.

The control panel is an integral part of the coil. The panel mounts on the side of the duct and contains:

- ▶ Automatic reset thermal cut out.
- ▶ Secondary protection with replaceable heat limiter.
- ▶ Positive pressure air flow switch.
- ▶ PE switch for each step of control (pneumatic units).
- ▶ Magnetic contactor for each step of control (electronic units).
- ▶ Fuses per NEC (coils over 48 amps).
- ▶ Optional features, see page G37.



APPLICATION

PP-8516 static or velocity pressure controller is used for central system constant static pressure regulation. The supply air fan output is controlled either by vortex damper or by fan speed control. Continuous static pressure indication or reset to central cooling controller output signal is also provided.

SPECIFICATIONS

Static/Velocity Pressure Setpoint (SPS): Adjustable 0.04 to 6" (1 to 152 mm) W.C., marked 0-100%.

Static/Velocity Pressure Throttling Range: Adjustable 10 to 200% of the static pressure setpoint. Additional T.R. by resistor selection.

Inputs: 0.04 to 6" (1 to 152 mm) W.C. static pressure.

Reset:

Slave Input, 2 to 15 Vdc from master unit.

Remote Setpoint, 0.24 to 3.81 Vdc, to change setpoint from 0 to 100%.

Outputs:

Fan or Vortex Damper Control, 2 thru 15 Vdc @ 12 mA, factory set 6 to 9 Vdc.

Indication, 1 to 11 Vdc @ 2 mA.

Master Signal to Slave Units, 2 thru 15 Vdc.

Power Requirements: 24 Vac @ 3 VA.

Power Supply Available:

20 Vdc, 50 mA.

6.2 Vdc, 4 mA.

Environment:

Ambient Temperature Limits,

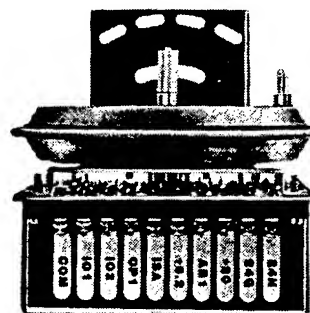
Shipping and Storage -40 to 160°F (-40 to 71°C).

Operating 40 to 140°F (4 to 60°C).

Humidity, 5 to 95% RH, non-condensing.

Locations, NEMA Type 1 indoor only.

Tap Over Pressure, 50 in. (127 cm) W.C.



Connections: See Figure 1 for designations.

Wiring, Coded screw terminals.

Air Pressure Taps, 2 high and 2 low, barbed for 1/4" O.D. plastic tubing.

Cover: Aluminum.

Mounting: ±15° from horizontal on vertical surface. Avoid locations where high radio frequency or electromagnetic interference generating devices are near.

Dimensions: 4-3/4" high × 4-7/8" wide × 5-7/8" deep (120 mm × 122 mm × 149 mm).

ACCESSORIES

AP-302	Duct static pressure sensing tips for pressure 1" (25.4 mm) W.C. and up
AP-305	Duct static pressure sensing tip for pressure 0.01" (0.3 mm) W.C. and up
ASP-589-060	0 to 6" (0 to 152 mm) W.C. static pressure indication meter, dual scale
AT-8901	Remote setpoint adjuster

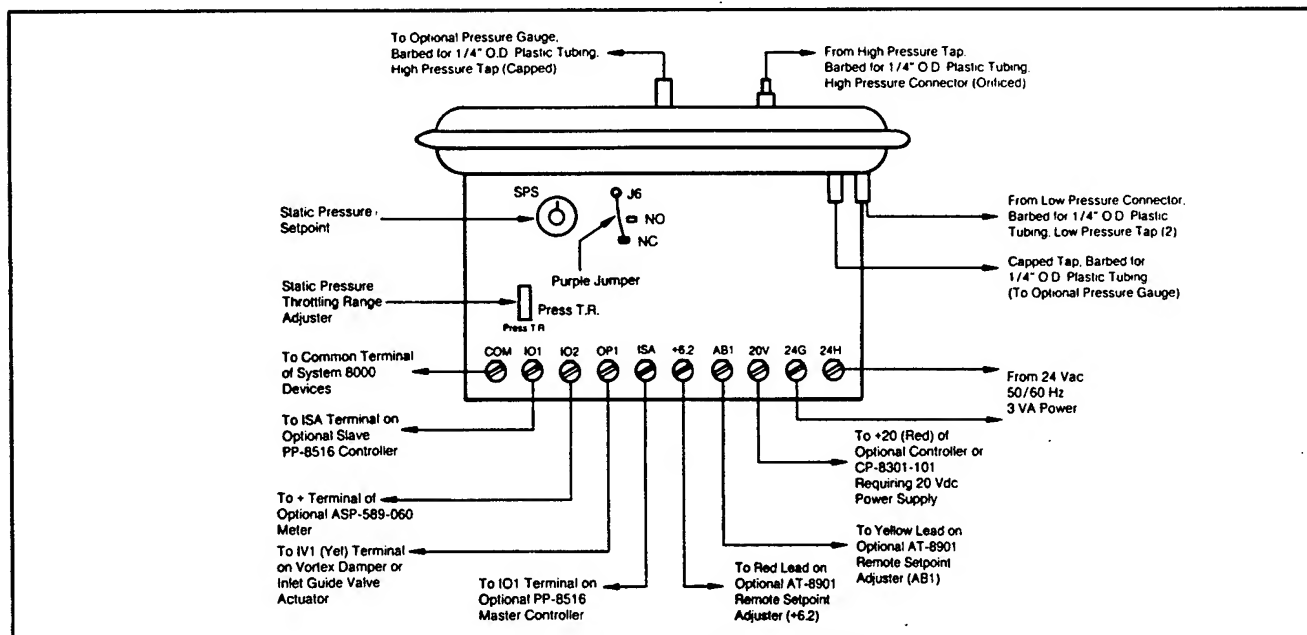


Figure 1. Typical System Wiring and Piping

VAV Terminal Controller

PP-8121

ELECTRIC/ELECTRONIC

APPLICATION

PP-8121 controller senses both velocity pressure and space temperature to control pressure for pressure independent air conditioning terminal units for space temperature regulation in Variable Air Volume Air Distribution Systems. Continuous velocity pressure indication output signal also provided.

SPECIFICATIONS

General: The terminal unit is controlled to maintain a set space temperature independent of up-stream static or velocity pressure. The setpoint of the airflow controller is reset to increase or decrease the airflow (CFM) from the terminal unit to maintain the temperature at setpoint when the space temperature drifts from the setpoint.

Temperature Setpoint (SPA): Adjustable 41 to 95°F (5 to 35°C).

Airflow Setpoint (SPS): Adjustable 0 to 100%, 0.01 to 1.5" (0.25 to 38.1 mm) W.C.; factory set at midrange for the terminal unit size in the range of 0.01 to 1.5" (0.25 to 38.1 mm) W.C. [400 to 4800 ft./min. (2.03 to 24.38 m/s) at 70°F (21°C)].

High Flow Limit: Adjustable 0 to 100%.

Low Flow Limit: Adjustable 0 to 100%.

Air Conditioning Terminal Unit Airflow Range: 100 thru 5000 CFM.

Inputs:

Velocity Pressure, 0.01 to 1.5" (0.25 to 38.1 mm), W.C. [400 to 4800 ft./min. (2.03 to 24.38 m/s) at 70°F (21°C)].

Temperature Sensor, 1000 ohm Balco, typically TS-8101 or TS-8111.

Reset:

Pressure Control, 1 to 11 Vdc.

Temperature Control, 2 to 15 Vdc.

Remote Setpoint, AT-8000 series, typically AT-8158.

Outputs:

Damper Control, 2 thru 15 Vdc at 12 mA, D.A. or R.A.

Indication, 1 to 11 Vdc at 2 mA.

Other Controlled Devices, 2 thru 15 Vdc at 12 mA.

Throttling Range:

Temperature, 3, 6, 9°F (2, 3, 5°C), by jumper; factory set at 3°F (2°C).

Pressure, 10 to 200%, factory set at 63%.

Power Requirements: 24 Vac @ 3 VA.

Power Supply Available: 20 Vdc @ 50 mA; 6.4 Vdc @ 4 mA.

Environment:

Ambient Temperature Limits,

Shipping and Storage -40 to 160°F (-40 to 71°C).

Operating 40 to 140°F (4 to 60°C).

Humidity, 5 to 95% RH, non-condensing.

Locations, NEMA Type 1 indoor only.

Tap Over Pressure, 15 in. (381 mm) W.C.

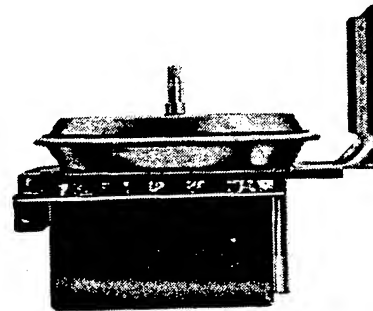
Connections: See Figure 1 for designations.

Wiring, Coded screw terminals.

Air Pressure Taps, 2 high and 2 low, barbed fittings for 1/4" O.D. plastic tubing.

Cover: Aluminum.

Mounting: ±15° from horizontal on vertical surface. Avoid locations where high radio frequency or electromagnetic interference generating devices are near.



Feb. '95
\$164.97

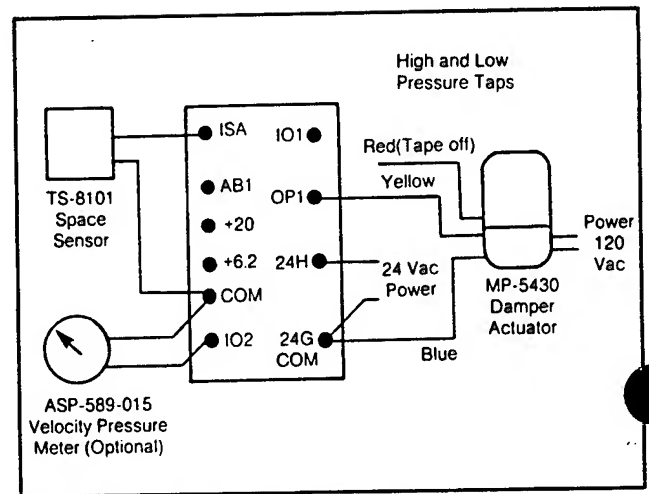


Figure 1. Typical Wiring PP-8121 Terminal Unit Control

Dimensions: 4-3/4" high x 4-7/8" wide x 5-7/8" deep (120 mm x 122 mm x 149 mm).

Velocity Pressure Sensor: Flow stations which provide traverse and averaging results are recommended. The PP-8000 series are usable with air station pickups; orifice rings and other pressure sensors available from other manufacturers.

ACCESSORIES

AP-305	Duct static pressure sensing tip for pressure 0.01" (0.25 mm) and up
ASP-589-015	0 to 1-1/2" (0 to 3.8 cm) W.C. velocity pressure indication meter.
AT-8158	Remote setpoint adjuster, dual scale 55 to 85°F (13 to 29°C)
AT-8258-101	Night setback scale for AT-8158
AT-8901	Remote setpoint adjuster
CC-8101	Electronic single stage relay
TP-8101	Room temperature controller
TP-8124	Room temperature controller/dual setpoints
TS-8101	Room sensor
TS-8111	Room sensor with setpoint
TS-8241	Diffuser sensor
TS-8261	Light fixture sensor
TS-8501	Outdoor sensor
TS-8601	Selective ratio discharge sensor

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd. 9755 Dogwood Rd.
Suite C-200 Suite 220
Denver, CO 80227 Roswell, GA 30075
(303) 988-2951 (404) 642-1864

JOB 1406.005 HVAC Upgrade FRiley, KS.
SHEET NO. _____ OF _____
CALCULATED BY C. Wohler DATE 3/15/95
CHECKED BY _____ DATE _____
SCALE _____

BARBER-COLEMAN CONTROLS

Rec'd Shoemaker Barber colman Price Quote for controls

- DDC Micro net w/ Built in actuator (VAV Box controller) \$230 }
+ Pressure probe for each Box \$40 } \$270/Box
- for static pressure transducer (pp-8311) = \$200 ~~per~~
- Electric VAV Box controller \$160 ^{ea}
- AHU Controller \$ 245 ^{ea}



BUILDING 222 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	563.48	303.54	259.94	259.94
Annual Natural Gas (MBTU)	200.97	327.96	-126.99	-126.99
Electric Demand June (KW)	37.86	26.34	11.52	11.52
Electric Demand July (KW)	46.42	33.73	12.70	12.70
Electric Demand August (KW)	45.10	29.17	15.92	15.92

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 222B (sq.ft.)	8412
ECO Model Bldg 222B (sq.ft.)	8412
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE: 05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 222 - Replace SZ AHU w/ VAV AHU

A. CONSTRUCTION COST	=	\$28,530
B. SIOH COST	(5.5% of 1A) =	\$1,569
C. DESIGN COST	(6.0% of 1A) =	\$1,712
D. TOTAL COST	(1A + 1B + 1C) =	\$31,811
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$31,811

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	JAN '95 DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	260	\$3,145	15.88	\$49,947
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(127)	(\$523)	18.30	(\$9,575)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$809	14.88	\$12,042
F. TOTAL		133	\$3,431		-----> \$52,415

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$0
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST				\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$14,214	5	0.863	\$12,267
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$14,214			\$12,267

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$12,267

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$4,142
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.68
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$64,681
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	2.03

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET		1		OF		1	
		DATE PREPARED		4-May-95					
		ESTIMATOR		C. Wohler					
		CHECKED BY		A. Niemeyer					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 222							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	1.0	\$4,433.18	\$4,433	Q-6	40	\$804
6	VSD15	VARIABLE SPEED DRIVE W/ CONTRLER,15HP	EA.	1.0	\$4,060.11	\$4,060	1-ELEC	19	\$398
7	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	2.0	\$154.07	\$308	Q-5	1.32	\$51
8	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	120.0	\$2.10	\$252	Q-1	0.151	\$351
9	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	25.0	\$5.28	\$132	Q-15	0.34	\$165
10		FITTINGS ADD 5%			\$0.37				\$25.81
11	CNTV2.5	CONTROL VALVE 2-1/2"	EA.	1.0	\$935.09	\$935	1-PLUM	3.556	\$77
12	CNTV1	CONTROL VALVE 1"	EA.	2.0	\$190.89	\$382	1-PLUM	0.471	\$20
13	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	12.5	\$0.62	\$8	Q-14	0.073	\$17
14	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	0.0	\$1.60	\$0	Q-14	0.089	\$0
15	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	1010.0	\$0.47	\$470	Q-10	0.094	\$1,845
16	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	\$24.23	\$48	1-ELEC	0.8	\$33
17	WIRE#12	COPPER WIRING #12	C.L.F.	1.5	\$7.41	\$11	1-ELEC	0.727	\$23
18	12"RDUCT	12 IN. DIA. ROUND DUCT, GAL. STL	L.F.	60.0	\$2.73	\$164	Q-9	0.133	\$150
19	9X9DIFF	9X9 SA DIFFUSERS	EA.	8.0	\$56.69	\$453	1-SHEE	0.571	\$95
20	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	\$310.08	\$620	1-SHEE	1.48	\$62
21	DTINSL1"	DUCT INSULATION, 1" THICK	S.F.	1010.0	\$0.48	\$489	Q-14	0.046	\$856
22									\$1,345
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26	AHU		TON	1.9			Q-5	17.778	\$638
27	DUCT		TON	0.4			Q-5	17.778	\$129
28									
29									
30									
31									
32		SUBTOTAL				\$12,767			\$5,738
33	OH	OVERHEAD			17%	\$2,145			\$964
34	PRO	PROFIT			10%	\$1,491			\$670
35	CONT	CONTINGENCY			20%	\$3,281			\$1,475
	TOTAL COST					\$19,683			\$8,847
									\$18,505
									\$3,109
									\$2,161
									\$4,755
									\$28,530

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET 1 OF 1		DATE PREPARED 4-May-95		ESTIMATOR C. Wohler	
ENGINEER		E M C Engineers, Inc.		CHECKED BY		A. Niemeyer			
		Denver, CO							
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 222							
2		NON-RECURRING							
3		EXISTING SYSTEM REPLACEMENT							
4		8,000 CFM AHU	EA.	1.0	\$5,319.81				\$6,164
5	AHUH8000	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	25.0	\$5.28	Q-6	42	\$844	\$297
6	STLPIP2.5	FITTINGS ADD 5%			\$0.26	Q-15	0.34	\$8.24	\$8
7		2.5" FIBERGLASS PIPE INSULATION, 1.5" THICK	L.F.	25.0	\$1.60	Q-14	0.089	\$41	\$81
8	INSLPIP2.5	GAL. STEEL DUCTWORK, UNDER 200 LB.	LB.	125.0	\$1.51	Q-10	0.102	\$248	\$437
9	DUCT200	CONTROL VALVE 2-1/2"	EA.	1.0	\$935.09	1-PLUM	3.556	\$77	\$1,012
10	CNTV2.5	CONTROL VALVE 2"	EA.	1.0	\$397.29	1-PLUM	0.889	\$19	\$416
11	CNTV2	DUCT INSULATION, 1" THICK	S.F.	125.0	\$0.48	Q-14	0.046	\$106	\$166
12	DTINSL1"								
13									
14									
15									
16									
17									
18									
19									
20		EXISTING SYSTEMS DEMOLITION	TON	1.9		Q-5	17.778	\$638	\$638
21		AHU							
22									
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL			\$7,074			\$2,146	\$9,219
32	OH	OVERHEAD			17%			\$360	\$1,549
33	PRO	PROFIT			10%			\$251	\$1,077
34	CONT	CONTINGENCY			20%			\$551	\$2,369
35	TOTAL COST				\$10,906			\$3,308	\$14,214

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 222							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0

DEMAND LIMITING ANALYSIS BUILDING 222

	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
SUMMER PEAK (KW) = 27812												
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT @ .20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	1270	1592	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.52
CAPACITY (KW)	32459	34436	26136	20754	26400	22752	27108	25812	23310	21834	21996	30084
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32721	34749	26373	20775	26453	22820	27244	25916	23404	21878	22084	30450
80% SUMMER PEAK (KVA)	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32721	34749	27799	27799	27799	27799	27799	27799	27799	27799	27799	30450
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,090.33	\$138,302.70	\$110,156.16	\$110,156.16	\$110,156.16	\$110,156.16	\$110,156.16	\$110,156.16	\$110,156.16	\$110,156.16	\$110,156.16	\$120,892.02
SUB DISCOUNT @ .20	(\$6,544.21)	(\$6,949.76)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$6,089.98)
CAPACITY CHARGE	\$126,136.12	\$133,942.94	\$107,186.35	\$107,186.35	\$107,186.35	\$107,186.35	\$107,186.35	\$107,186.35	\$107,186.35	\$107,186.35	\$107,186.35	\$117,392.04
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,198.74	\$68,177.18	\$54,541.74	\$54,541.74	\$54,541.74	\$54,541.74	\$54,541.74	\$54,541.74	\$54,541.74	\$54,541.74	\$54,541.74	\$59,742.67
100*KVA @ \$.03404	\$111,382.52	\$118,284.97	\$94,627.97	\$94,627.97	\$94,627.97	\$94,627.97	\$94,627.97	\$94,627.97	\$94,627.97	\$94,627.97	\$94,627.97	\$103,651.39
250*KVA @ \$.03084	\$252,279.45	\$267,913.37	\$210,024.78	\$184,119.18	\$214,330.69	\$214,330.69	\$214,330.69	\$214,330.69	\$214,330.69	\$212,800.38	\$171,166.38	\$234,768.58
EXCESS @ \$.02864	\$109,736.22	\$65,885.57	\$0.00	\$0.00	\$1,156.46	\$51,849.26	\$42,398.06	\$32,946.86	\$38,961.26	\$0.00	\$0.00	\$28,354.97
ENERGY CHARGE	\$537,596.93	\$520,261.08	\$359,194.50	\$333,288.90	\$364,656.86	\$415,349.66	\$405,898.46	\$396,447.26	\$402,461.66	\$361,970.10	\$320,336.10	\$426,517.61
TOTAL CHARGE LESS ECA	\$663,733.05	\$654,204.02	\$466,380.85	\$440,475.25	\$471,843.22	\$522,536.02	\$513,084.82	\$503,633.62	\$509,648.02	\$469,156.45	\$427,522.45	\$543,909.65
SUMMARY												
MONTHLY DIFFERENCE	\$70.02	\$87.90	\$59.00	\$59.00	\$70.32	\$70.32	\$70.32	\$70.32	\$70.32	\$59.00	\$59.00	\$63.77
ANNUAL DIFFERENCE.....		\$809.29										

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 15:22:48 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 8 RECTANGULAR 8 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - G L A S S - - -		- - - W A L L - - -		- - - W A L L + G L A S S -		AZIMUTH
		U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	
LIQUOR-STR		0.619	148.50	0.231	161.50	0.417	310.00	EAST
OFFIC-AREA		0.799	134.25	0.231	855.75	0.308	990.00	EAST
LIQ-STORAG		1.021	54.00	0.231	476.00	0.311	530.00	WEST
LIQUOR-STR		1.021	12.00	0.231	428.00	0.252	440.00	WEST
OFFIC-AREA		1.021	18.00	0.231	312.00	0.274	330.00	WEST
LIQUOR-STR		0.000	0.00	0.067	2411.50	0.067	2411.50	ROOF
LIQ-STORAG		0.000	0.00	0.067	1377.00	0.067	1377.00	ROOF
OFFIC-AREA		0.000	0.00	0.067	4620.00	0.067	4620.00	ROOF
LIQUOR-STR		0.000	0.00	0.020	2411.50	0.020	2411.50	UNDERGRND
LIQ-STORAG		0.000	0.00	0.020	1377.00	0.020	1377.00	UNDERGRND
OFFIC-AREA		0.000	0.00	0.020	4620.00	0.020	4620.00	UNDERGRND

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 15:22:48 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
RESORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE		AVERAGE U-VALUE		GLASS		OPAQUE		GLASS+OPAQUE
	U-VALUE/GLASS (BTU/HR-SQFT-F)	U-VALUE/WALLS (BTU/HR-SQFT-F)	WALLS+GLASS (BTU/HR-SQFT-F)	WALLS+GLASS (BTU/HR-SQFT-F)	AREA (SQFT)	AREA (SQFT)	AREA (SQFT)	AREA (SQFT)	
EAST	0.704	0.231	0.334	0.334	282.75	1017.25	1300.00	1300.00	
WEST	1.021	0.231	0.282	0.282	84.00	1216.00	1300.00	1300.00	
ROOF	0.000	0.067	0.067	0.067	0.00	8408.50	8408.50	8408.50	
ALL WALLS	0.777	0.231	0.308	0.308	366.75	2233.25	2600.00	2600.00	
WALLS+ROOFS	0.777	0.101	0.124	0.124	366.75	10641.75	11008.50	11008.50	
UNDERGRND	0.000	0.020	0.020	0.020	0.00	8408.50	8408.50	8408.50	
BUILDING	0.777	0.065	0.079	0.079	366.75	19050.25	19417.00	19417.00	

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 15:22:48 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 8412 SQFT 781 SQMT
VOLUME 84120 CUFT 2382 CUMT

COOLING LOAD

TIME
DRY-BULB TEMP
WET-BULB TEMP

AUG 11 4PM
100F 38C
71F 22C

HEATING LOAD
JAN 5 6AM
2F -17C
1F -17C

	SENSIBLE		LATENT	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	6.351	1.860	0.000	0.000
ROOFS	41.676	12.206	0.000	0.000
GLASS CONDUCTION	5.916	1.733	0.000	0.000
GLASS SOLAR	13.015	3.812	0.000	0.000
DOOR	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.796	-0.233	0.000	0.000
OCCUPANTS TO SPACE	10.432	3.055	18.594	5.446
LIGHT TO SPACE	32.061	9.390	0.000	0.000
EQUIPMENT TO SPACE	1.502	0.440	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000
INFILTRATION	3.605	1.056	0.495	0.145
TOTAL	113.762	33.318	19.089	5.591
TOTAL LOAD	132.851	KBTU/H	38.909	KW
TOTAL LOAD / AREA	15.79	BTU/H.SQFT	49.787	W /SQMT

	SENSIBLE	
	(KBTU/H)	(KW)
WALLS	-30.240	-8.857
ROOFS	-43.122	-12.629
GLASS CONDUCTION	-21.846	-6.398
GLASS SOLAR	0.790	0.231
DOOR	0.000	0.000
INTERNAL SURFACES	0.000	0.000
UNDERGROUND SURFACES	-4.828	-1.414
OCCUPANTS TO SPACE	0.258	0.076
LIGHT TO SPACE	1.578	0.462
EQUIPMENT TO SPACE	0.122	0.036
PROCESS TO SPACE	0.000	0.000
INFILTRATION	-9.612	-2.815
TOTAL	-106.899	-31.308
TOTAL LOAD	-106.899	KBTU/H
TOTAL LOAD / AREA	12.708	BTU/H.SQFT

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 15:22:48 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR EXIST-SZ TOPEKA, KS

MONTH	COOLING				MAXIMUM COOLING LOAD (KBTU/HR)	HEATING				H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)					
JAN	0.00000				0.000	-41.257	5	2. F	1. F	-130.471	10749.	19.486				
FEB	0.00000				0.000	-26.324	3	-2. F	-3. F	-128.690	10065.	19.486				
MAR	0.00000				0.000	-15.901	3	15. F	12. F	-104.184	10827.	19.486				
APR	0.00000				0.000	-2.942	5	30. F	27. F	-64.762	10557.	19.486				
MAY	34.04383	16	2	62. F	59. F	-0.252	5	56. F	51. F	-5.173	10788.	19.486				
JUN	68.72543	28	18	89. F	76. F	0.000				0.000	10562.	19.486				
JUL	82.82845	23	17	97. F	79. F	0.000				0.000	10837.	19.486				
AUG	80.37974	23	16	96. F	77. F	0.000				0.000	10774.	19.486				
SEP	51.19699	8	18	89. F	72. F	0.000				0.000	10596.	19.486				
OCT	0.74884	1	18	83. F	68. F	-1.288	2	59. F	56. F	-46.899	10783.	19.486				
NOV	0.00000				0.000	-11.923	3	19. F	17. F	-90.120	10523.	19.486				
DEC	0.00000				0.000	-34.444	6	15. F	12. F	-104.639	10857.	19.486				
TOTAL	317.923					-134.332					127914.					
MAX					411.602					-130.471		19.486				

D1-9

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 15:22:48 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR EXIST-SZ TOPEKA, KS

MONTH	HOURS COOLING		HOURS HEATING		HOURS COOL-HEAT		N U M B E R		O F		H O U R S		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS FLOA TING	
-------	---------------	--	---------------	--	-----------------	--	-------------	--	-----	--	-----------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--	---------------	--	---------------	--	---------------	--	-----------------	--

MO	UTILITY - TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY TOTAL (MBTU) PEAK (KBTU) DY/HR	NATURAL-GAS TOTAL (MBTU) PEAK (KBTU) DY/HR
JAN	38.580 69.432 28/20	38.580 69.432 28/20	58.939 164.720 5/ 6
FEB	35.801 69.432 17/14	35.801 69.432 17/14	39.212 162.852 3/ 8
MAR	37.887 67.847 15/10	37.887 67.847 15/10	24.283 136.662 3/ 8
APR	36.300 66.739 22/20	36.300 66.739 22/20	5.417 92.636 5/ 7
MAY	49.591 151.485 16/ 2	49.591 151.485 16/ 2	0.809 10.586 5/21
JUN	61.662 129.216 28/17	61.662 129.216 28/17	0.000 0.000 30/ 1
JUL	67.182 158.445 23/16	67.182 158.445 23/16	0.000 0.000 31/ 1
AUG	67.088 153.911 11/16	67.088 153.911 11/16	0.000 0.000 31/ 1
SEP	56.552 123.854 8/18	56.552 123.854 8/18	0.000 0.000 30/ 1
OCT	37.322 84.063 1/17	37.322 84.063 1/17	3.007 71.915 2/ 3
NOV	36.719 68.254 12/10	36.719 68.254 12/10	18.927 121.224 3/ 7
DEC	38.798 69.432 20/10	38.798 69.432 20/10	50.370 137.157 6/ 7
ONE YEAR USE/PEAK			200.965 164.720

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	7.20	200.97
SPACE COOL	119.51	0.00
HVAC AUX	263.82	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	167.47	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	5.49	0.00
TOTAL	563.48	200.97

TOTAL SITE ENERGY 764.45 MBTU 144.1 KBTU/SQFT-YR GROSS-AREA 90.9 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1893.10 MBTU 356.9 KBTU/SQFT-YR GROSS-AREA 225.0 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.1
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. 80227		EZDOE - ELITE SOFTWARE DEVELOPMENT INC		DOE-2 ID 2/28/1995		11: 9: 1		SDL RUN 1			
DENVER, CO		PROPOSED MODIFICATION OF BLDG 222		LIQUOR STORE AND TRAINING AREA							
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR		ZONED VAVAHU		TOPEKA, KS							
- - - - -		C O O L I N G		- - - - -		H E A T I N G		- - - - -			
COOLING ENERGY (MBTU)		TIME OF MAX DY HR		DRY- BULB TEMP		WET- BULB TEMP		MAXIMUM HEATING LOAD (KBTU/HR)			
ELEC- TRICAL ENERGY (KWH)		ELEC- MAXIMUM LOAD (KW)									
MONTH											
JAN	0.00000					-48.131	5 6	2. F 1. F	-125.864	4133.	9.751
FEB	0.00000					-33.947	3 8	-2. F -3. F	-126.408	4081.	14.062
MAR	0.00000					-25.861	3 8	15. F 12. F	-106.032	4477.	18.211
APR	0.00000					-6.880	5 7	30. F 27. F	-74.130	6269.	18.211
MAY	20.82284	16	2	62. F	59. F	-2.729	5 6	44. F 40. F	-47.105	5255.	18.211
JUN	41.31012	28	18	89. F	76. F	0.000			0.000	4455.	11.850
JUL	51.71537	23	17	97. F	79. F	0.000			0.000	4665.	12.470
AUG	50.77260	24	17	95. F	77. F	0.000			0.000	4630.	12.678
SEP	29.09936	8	18	89. F	72. F	0.000			0.000	4314.	11.318
OCT	0.42921	1	17	85. F	68. F	-5.874	2 2	64. F 59. F	-104.152	6228.	18.211
NOV	0.00000					-20.271	3 6	13. F 12. F	-93.369	5025.	18.211
DEC	0.00000					-42.598	6 7	15. F 12. F	-106.758	4210.	9.698
TOTAL	194.149					-186.290				57743.	
TAX									-126.408		18.211

D1-12

EMC ENGINEERS INC.		EZDOE - ELITE SOFTWARE DEVELOPMENT INC		DOE-2.1D		2/28/1995		11: 9: 1		SDL RUN 1	
DENVER, CO		80227		PROPOSED MODIFICATION OF BLDG 222		LIQUOR STORE AND TRAINING AREA					
REPORT- SS-C		SYSTEM MONTHLY LOAD HOURS FOR		2001-02 VAV/HH		TOPEKA, KS					
----- N U M B E R O F H O U R S -----											
		HOURS		HOURS		HOURS		HOURS		HOURS	
		COOL-HEAT		COOLING		FANS ON		FANS ON		FANS ON	
		LOAD		AVAIL.		CYCLE ON		VENTING		LOAD AT	
										COOLING	
										PEAK	
										PEAK	
										(KW)	

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 11: 9: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR ZON-2-UTHT TOPEKA, KS

C O O L I N G				H E A T I N G				E L E C			
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000			0.000	-8.147	16	14.F	11.F	-35.056	371.	1.424
FEB	0.00000			0.000	-6.067	3	-2.F	-3.F	-30.266	354.	1.415
MAR	0.00000			0.000	-4.800	3	17.F	13.F	-26.238	388.	1.407
APR	0.00000			0.000	-1.526	5	37.F	32.F	-18.540	367.	1.396
MAY	0.00000			0.000	-0.216	5	46.F	41.F	-11.000	371.	1.387
JUN	0.00000			0.000	0.000				0.000	367.	1.378
JUL	0.00000			0.000	0.000				0.000	385.	1.378
AUG	0.00000			0.000	0.000				0.000	367.	1.378
SEP	0.00000			0.000	0.000				0.000	376.	1.378
OCT	0.00000			0.000	-1.190	20	29.F	29.F	-16.250	371.	1.395
NOV	0.00000			0.000	-3.988	3	29.F	24.F	-22.622	361.	1.402
DEC	0.00000			0.000	-7.269	14	10.F	8.F	-32.730	400.	1.419
TOTAL	0.000				-33.204					4476.	
MAX				0.000					-35.056		1.424

D1-13

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 11: 9: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR ZON-2-UTHT TOPEKA, KS

HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS			
-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	--	--

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY TOTAL (MBTU) PEAK (KBTU) DY/HR	NATURAL-GAS TOTAL (MBTU) PEAK (KBTU) DY/HR
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	17.909 41.492 15/10	80.229 199.821 5/ 6
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	17.312 52.719 26/17	59.418 198.143 3/ 8
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	18.442 66.887 27/17	46.781 168.657 3/ 7
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.295 66.887 16/19	13.851 128.341 5/ 7
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	27.921 125.391 16/ 2	5.244 88.430 5/ 6
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	33.262 89.905 28/17	0.000 0.000 30/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	37.433 115.105 23/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	37.423 99.562 11/16	0.000 0.000 31/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	29.028 83.375 8/18	0.000 0.000 30/ 1
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.344 66.887 27/20	11.932 150.185 2/ 2
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	19.962 66.887 23/20	37.866 153.982 3/ 7
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	18.213 41.476 14/11	72.634 174.148 6/ 7
ONE YEAR USE/PEAK		303.543 125.391	327.956 199.821

EMC ENGINEERS INC. 80227 EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 11: 9: 1 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	12.07	327.96
SPACE COOL	79.04	0.00
HVAC AUX	39.48	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	167.47	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	5.49	0.00
TOTAL	303.54	327.96

TOTAL SITE ENERGY 631.50 MBTU 119.1 KBTU/SQFT-YR GROSS-AREA 75.1 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1239.50 MBTU 233.7 KBTU/SQFT-YR GROSS-AREA 147.3 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 51.8
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.



BUILDING 5000 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	408.42	326.52	81.90	81.90
Annual Natural Gas (MBTU)	275.56	79.38	196.18	196.18
Electric Demand June (KW)	31.33	30.30	1.03	1.03
Electric Demand July (KW)	31.90	31.79	0.11	0.11
Electric Demand August (KW)	31.75	33.01	-1.26	-1.26

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 5000 (sq.ft.)	4667
ECO Model Bldg 5000 (sq.ft.)	4667
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/08/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohlert

1. INVESTMENT: BLDG 5000 - Replace MZ AHU w/ 3 Furnace Air Conditioning Units

A. CONSTRUCTION COST	=	\$37,026
B. SIOH COST	(5.5% of 1A) =	\$2,036
C. DESIGN COST	(6.0% of 1A) =	\$2,222
D. TOTAL COST	(1A + 1B + 1C) =	\$41,284
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$41,284

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	82	\$991	15.88	\$15,737
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	196	\$808	18.30	\$14,793
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			(\$47)	14.88	(\$701)
F. TOTAL		278	\$1,752		-----> \$29,829

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$9,696
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST				\$9,696

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$72,986	5	0.863	\$62,987
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$72,986			\$62,987

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$72,683

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$6,053
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	6.82
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$102,511
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	2.48

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT Fort Riley Feasibility Study for HVAC Upgrade									
ENGINEER E M C Engineers, Inc. Denver, CO									
SHEET 1 OF 1		DATE PREPARED 8-May-95		ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 5000							
2		PROPOSED SYSTEM MODIFICATIONS							
3		NEW SYSTEMS INSTALLATION							
4		FURNACE AIR CONDITIONER, 4 TON	EA.	1.0	\$1,782.96	Q-9	20	\$375	\$2,158
5	FAC1	FURNACE AIR CONDITIONER, 5 - 6 TON	EA.	2.0	\$2,596.92	Q-10	24	\$933	\$6,126
6	FAC2	4 TON ACCU	EA.	1.0	\$1,405.05	Q-5	17.778	\$345	\$1,750
7	ACCU4	5 TON ACCU	EA.	1.0	\$1,719.98	Q-5	26.667	\$517	\$2,237
8	ACCU5	7.5 TON ACCU	EA.	1.0	\$3,125.03	Q-5	29.091	\$564	\$3,689
9	ACCU7.5	COPPER TUBE, TYPE L, 3/4" OD	L.F.	225.0	\$1.41	1-PLUM	0.103	\$499	\$815
10	MCUPIP1	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	600.0	\$0.47	Q-10	0.094	\$1,096	\$1,375
11	DUCT100	10 IN. DIA. FLEX DUCT	L.F.	10.0	\$2.55	Q-9	0.114	\$21	\$47
12	10"FLEX	MODULAR HW BOILER, 320 MBH	EA.	1.0	\$2,640.53	Q-7	40	\$822	\$3,463
13	MODBLR1	1/3 HP, CI FLANGE, IN-LINE, 3/4"-1-1/2" SIZE	EA.	1.0	\$300.39	Q-1	2.667	\$52	\$352
14	HWP1								
15									
16									
17									
18									
19									
20			0						
21		EXISTING SYSTEMS DEMOLITION							
22		BOILER DEMOLITION	EA.	1.0		Q-6	12	\$241	\$241
23		MZ AHU DEMOLITION	TON	1.0		Q-5	14.545	\$282	\$282
24		HOT WATER PIPING DEMOLITION	L.F.	50.0		1-PLUM	0.04	\$43	\$43
25		DUCTWORK DEMOLITION	L.F.	50.0		1-CLAB	0.107	\$77	\$77
26		ASBESTOS REMOVAL	GLV. BAG	8.0	\$170.00				\$1,360
27									
28									
29									
30									
31		SUBTOTAL							\$24,016
32	OH	OVERHEAD			17%			\$5,867	\$4,035
33	PRO	PROFIT			10%			\$986	\$2,805
34	CONT	CONTINGENCY			20%			\$685	\$6,171
35	TOTAL COST							\$1,508	\$37,026

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET	1	OF	1
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	4-May-95		
		ESTIMATOR	C. Wohler		
		CHECKED BY	A. Niemeyer		

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 5000								
2		NON-RECURRING								
3										
4										
5	HWBLR1	BASELINE - EXISTING EQUIP. REPLACEMENT	EA.	1.0	\$5,354	\$5,354	Q-7	58.182	\$1,196	\$6,550
6	MZ15TON	765 MBH HOT WATER BOILER (Cast Iron)	EA.	1.0	\$31,115	\$31,115	Q-7	145	\$2,980	\$34,095
7	ACCU15	15 TON MULTIZONE AHU	EA.	1.0	\$5,184	\$5,184	Q-5	40	\$776	\$5,960
8		15 TON ACCU								
9										
10										
11										
12										
13		EXISTING SYSTEMS DEMOLITION								
14		BOILER DEMOLITION	EA.	1.0			Q-6	12	\$241	\$241
15		MZ AHU DEMOLITION	TON	1.0			Q-5	14.545	\$282	\$282
16		ACCU DEMOLITION	TON	0.8			Q-5	14.545	\$212	\$212
17										
18										
19			0							
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		SUBTOTAL				\$41,652			\$5,687	\$47,339
32	OH	OVERHEAD			17%	\$6,998			\$955	\$7,953
33	PRO	PROFIT			10%	\$4,865			\$664	\$5,529
34	CONT	CONTINGENCY			20%	\$10,703			\$1,461	\$12,164
35		TOTAL COST				\$64,218			\$8,768	\$72,986

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		Total	LABOR COST		TOTAL
				Quantity	Unit Cost		Crew/ Worker	Hours/ Unit	
1		BUILDING 5000							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	1.0	\$48.45	\$48	Q-6	17	\$342
5	MNT-AHU	MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.	1.0			Q-6	25	\$503
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$48	-	-	\$893
16									
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
18	MNT-FAC	MAINT. ON FAC - INSPEC. / YR	EA.	3.0			Q-6	4	\$241
19			0						
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$241
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$48	-	-	\$603
									\$652

DEMAND LIMITING ANALYSIS BUILDING 5000

SUMMER PEAK (KW) = 27812	1993												1993 JUN BILL 6/1-7/1 ACTUAL
	JUL BILL 7/1-8/2 ACTUAL	AUG BILL 8/2-9/1 ACTUAL	SEP BILL 9/3-10/1 ACTUAL	OCT BILL 10/1-11/1 ACTUAL	NOV BILL 11/1-12/1 ACTUAL	DEC BILL 12/1-1/3 ACTUAL	JAN BILL 1/4-2/1 ACTUAL	FEB BILL 2/1-3/1 ACTUAL	MAR BILL 3/3-4/1 ACTUAL	APR BILL 4/1-5/3 ACTUAL	MAY BILL 5/3-6/1 ACTUAL		
BASE CASE													
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096	1993
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23	\$120,939.23
SUB DISCOUNT \$ 20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42	\$543,973.42
DEMAND REDUCTION (KW)													
CAPACITY (KW)	0.11	(1.26)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	1.03
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%	98.80%
CAPACITY (KVA)	32734	34766	26373	20775	26453	22820	27244	25916	23404	21878	22084	30460	30460
80% SUMMER PEAK (KVA)	27813	27813	27813	27813	27813	27813	27813	27813	27813	27813	27813	27813	27813
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34766	27813	27813	27813	27813	27813	27813	27813	27813	27813	30460	30460
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,141.74	\$138,372.93	\$110,212.34	\$110,212.34	\$110,212.34	\$110,212.34	\$110,212.34	\$110,212.34	\$110,212.34	\$110,212.34	\$110,212.34	\$120,934.99	\$120,934.99
SUB DISCOUNT \$ 20	(\$6,546.75)	(\$6,953.23)	(\$5,562.58)	(\$5,562.58)	(\$5,562.58)	(\$5,562.58)	(\$5,562.58)	(\$5,562.58)	(\$5,562.58)	(\$5,562.58)	(\$5,562.58)	(\$6,092.10)	(\$6,092.10)
CAPACITY CHARGE	\$126,184.99	\$134,009.70	\$107,239.76	\$107,239.76	\$107,239.76	\$107,239.76	\$107,239.76	\$107,239.76	\$107,239.76	\$107,239.76	\$107,239.76	\$117,432.89	\$117,432.89
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000	13,170,000
50*KVA @ \$.03924	\$64,223.64	\$68,211.20	\$54,568.96	\$54,568.96	\$54,568.96	\$54,568.96	\$54,568.96	\$54,568.96	\$54,568.96	\$54,568.96	\$54,568.96	\$59,763.48	\$59,763.48
100*KVA @ \$.03404	\$111,425.73	\$118,343.99	\$94,675.19	\$94,675.19	\$94,675.19	\$94,675.19	\$94,675.19	\$94,675.19	\$94,675.19	\$94,675.19	\$94,675.19	\$103,687.51	\$103,687.51
250*KVA @ \$.03084	\$252,377.31	\$268,047.05	\$209,960.61	\$184,055.01	\$214,437.64	\$214,437.64	\$214,437.64	\$214,437.64	\$214,437.64	\$212,736.21	\$171,102.21	\$234,850.39	\$234,850.39
EXCESS @ \$.02864	\$109,590.81	\$65,686.93	\$0.00	\$0.00	\$997.54	\$51,690.34	\$42,239.14	\$32,787.94	\$38,802.34	\$0.00	\$0.00	\$28,233.41	\$28,233.41
ENERGY CHARGE	\$537,617.50	\$520,289.17	\$359,204.76	\$333,299.16	\$364,679.34	\$415,372.14	\$405,920.94	\$396,469.74	\$402,484.14	\$361,980.36	\$320,346.36	\$426,534.80	\$426,534.80
TOTAL CHARGE LESS ECA	\$663,802.48	\$654,298.87	\$466,444.52	\$440,538.92	\$471,919.09	\$522,611.89	\$513,160.69	\$503,709.49	\$509,723.89	\$469,220.12	\$427,586.12	\$543,967.69	\$543,967.69
MONTHLY DIFFERENCE													
ANNUAL DIFFERENCE.....	\$0.59	(\$6.95)	(\$4.67)	(\$4.67)	(\$5.56)	(\$5.56)	(\$5.56)	(\$5.56)	(\$5.56)	(\$4.67)	(\$4.67)	\$5.73	\$5.73

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 11 RECTANGULAR 11 OTHER 0
 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	WALL + GLASS (BTU/HR-SQFT-F)	AREA (SQFT)	GLASS (SQFT)	OPAQUE (SQFT)	GLASS+OPAQUE (SQFT)	AZIMUTH
N PERI_ZON		0.490	192.00	0.068	0.068	0.234	0.064	294.00	0.064	486.00	NORTH
N PERI_ZON		0.000	0.00	0.064	0.064	0.064	0.064	243.00	0.064	243.00	NORTH
S PERI_ZON		0.490	140.00	0.068	0.068	0.158	0.064	517.00	0.064	657.00	SOUTH
S PERI_ZON		0.000	0.00	0.064	0.064	0.064	0.064	328.50	0.064	328.50	SOUTH
S PERI_ZON		0.000	0.00	0.068	0.068	0.068	0.068	292.50	0.068	292.50	WEST
S PERI_ZON		0.000	0.00	0.064	0.064	0.064	0.064	97.50	0.064	97.50	WEST
N PERI_ZON		0.000	0.00	0.068	0.068	0.068	0.068	328.50	0.068	328.50	WEST
N PERI_ZON		0.000	0.00	0.064	0.064	0.064	0.064	109.50	0.064	109.50	WEST
S PERI_ZON		0.000	0.00	0.036	0.036	0.036	0.036	1776.00	0.036	1776.00	ROOF
N PERI_ZON		0.000	0.00	0.036	0.036	0.036	0.036	1333.00	0.036	1333.00	ROOF
CORE_ZONE		0.000	0.00	0.036	0.036	0.036	0.036	1801.25	0.036	1801.25	ROOF
S PERI_ZON		0.000	0.00	0.020	0.020	0.020	0.020	1776.00	0.020	1776.00	UNDERGRND
N PERI_ZON		0.000	0.00	0.020	0.020	0.020	0.020	1333.00	0.020	1333.00	UNDERGRND
CORE_ZONE		0.000	0.00	0.020	0.020	0.020	0.020	1553.75	0.020	1553.75	UNDERGRND

D1-23

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.490	0.066	0.178	192.00	537.00	729.00
SOUTH	0.490	0.066	0.126	140.00	845.50	985.50
WEST	0.000	0.067	0.067	0.00	828.00	828.00
ROOF	0.000	0.036	0.036	0.00	4910.25	4910.25
ALL WALLS	0.490	0.066	0.122	332.00	2210.50	2542.50
WALLS+ROOFS	0.490	0.045	0.065	332.00	7120.75	7452.75
UNDERGRND	0.000	0.020	0.020	0.00	4662.75	4662.75
BUILDING	0.490	0.035	0.048	332.00	11783.50	12115.50

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 4667 SQFT 434 SQMT
VOLUME 62998 CUFT 1784 CUMT

HEATING LOAD
=====

JAN 15 5AM
-8F -22C
-9F -23C

COOLING LOAD
=====

AUG 4 6PM
92F 33C
70F 21C

SENSIBLE
(KBTU/H) (KW)

SENSIBLE LATENT
(KBTU/H) (KW) (KBTU/H) (KW)

WALLS 5.442 1.594 0.000 0.000
ROOFS 11.284 3.305 0.000 0.000
GLASS CONDUCTION 1.979 0.580 0.000 0.000
GLASS SOLAR 10.219 2.993 0.000 0.000
DOOR 0.052 0.015 0.000 0.000
INTERNAL SURFACES 0.000 0.000 0.000 0.000
UNDERGROUND SURFACES -0.441 -0.129 0.000 0.000
OCCUPANTS TO SPACE 5.627 1.648 9.378 2.747
LIGHT TO SPACE 24.308 7.119 0.000 0.000
EQUIPMENT TO SPACE 21.276 6.231 0.000 0.000
PROCESS TO SPACE 0.000 0.000 0.000 0.000
INFILTRATION 0.000 0.000 0.000 0.000
TOTAL 79.746 23.356 9.378 2.747
TOTAL LOAD 89.124 KBTU/H 26.102 KW
TOTAL LOAD / AREA 19.10BTU/H.SQFT 60.207 W /SQMT

-26.864 KBTU/H
-7.868 KW
5.757BTU/H.SQFT
18.148 W /SQMT

*
* NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* ---- LOADS *
* 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ_SYSTEM TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				-49.094	15	5	-8.F -9.F	-171.380	8003.	19.956	
FEB	0.00000				-34.759	3	5	-1.F -2.F	-150.421	7193.	18.956	
MAR	0.00000				-24.629	4	5	14.F 12.F	-115.125	7957.	18.956	
APR	0.00000				-5.136	5	5	31.F 29.F	-70.895	7701.	18.956	
MAY	19.02822	31	16	88.F 75.F	-0.659	5	5	44.F 40.F	-26.835	9709.	31.032	
JUN	51.40051	24	12	84.F 76.F	0.000				0.000	12457.	31.318	
JUL	69.27947	1	16	86.F 80.F	0.000				0.000	14363.	31.889	
AUG	65.85220	20	13	92.F 78.F	0.000				0.000	14261.	31.736	
SEP	34.29221	22	18	85.F 75.F	0.000				0.000	10882.	31.165	
OCT	0.81302	1	18	83.F 68.F	-3.490	20	5	25.F 25.F	-81.055	8035.	29.008	
NOV	0.00000				-18.773	3	5	13.F 12.F	-114.579	7701.	18.956	
DEC	0.00000				-42.321	12	5	4.F 3.F	-138.342	7958.	18.956	
TOTAL	240.665				-178.861				-171.380	116219.	31.889	
MAX												

D1-25

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ_SYSTEM TOPEKA, KS

MONTH	N U M B E R O F H O U R S										C O I N C I D E N T L O A D S			
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS COINCIDENT LOAD	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE	HOURS FANS ON VENTING	HOURS FLOATING WHEN	HOURS LOAD AT COOLING PEAK	HEATING LOAD AT COOLING PEAK	ELECTRIC LOAD AT COOLING PEAK		
JAN	0	744	0	0	744	0	744	0	0	0	-60.222	3.847		
FEB	0	672	0	0	672	0	672	0	0	0	-58.174	3.847		
MAR	0	744	0	0	744	0	744	0	0	0	-61.906	3.847		
APR	0	720	0	0	720	0	720	0	0	0	-1.775	3.847		
MAY	244	360	0	140	384	744	744	0	140	0	0.000	24.295		
JUN	564	0	0	156	720	744	744	0	156	0	0.000	31.086		
JUL	707	0	0	37	744	744	744	0	37	0	0.000	24.691		
AUG	686	0	0	58	744	744	744	0	58	0	0.000	27.751		
SEP	410	0	0	310	720	744	744	0	310	0	0.000	30.654		
OCT	11	720	0	13	24	744	744	0	13	0	0.000	29.008		
NOV	0	720	0	0	0	720	744	0	0	0	-77.140	3.847		
DEC	0	744	0	0	744	0	744	0	0	0	-76.802	3.847		
ANNUAL	2622	5424	0	714	5424	3336	8760	0	0	0				

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY 29.860 72.103 15/12	NATURAL-GAS 71.294 216.188 15/ 5
JAN	TOTAL(MBTU) PEAK(KBTU) DY/HR	26.727 68.688 17/12	52.768 193.981 3/ 5
FEB	TOTAL(MBTU) PEAK(KBTU) DY/HR	28.923 68.688 29/12	38.822 155.443 4/ 5
MAR	TOTAL(MBTU) PEAK(KBTU) DY/HR	26.914 65.910 4/12	10.010 105.133 5/ 5
APR	TOTAL(MBTU) PEAK(KBTU) DY/HR	33.317 105.957 31/18	2.002 46.419 5/ 5
MAY	TOTAL(MBTU) PEAK(KBTU) DY/HR	42.535 106.933 28/12	0.000 0.000 30/ 1
JUN	TOTAL(MBTU) PEAK(KBTU) DY/HR	49.043 108.881 23/12	0.000 0.000 31/ 1
JUL	TOTAL(MBTU) PEAK(KBTU) DY/HR	48.695 108.360 21/12	0.000 0.000 31/ 1
AUG	TOTAL(MBTU) PEAK(KBTU) DY/HR	37.154 106.409 7/12	0.000 0.000 30/ 1
SEP	TOTAL(MBTU) PEAK(KBTU) DY/HR	27.931 99.046 1/18	7.424 116.889 20/ 5
OCT	TOTAL(MBTU) PEAK(KBTU) DY/HR	27.708 67.920 30/12	30.173 154.836 3/ 5
NOV	TOTAL(MBTU) PEAK(KBTU) DY/HR	29.608 68.688 31/12	63.063 180.953 12/ 5
DEC	TOTAL(MBTU) PEAK(KBTU) DY/HR		
	ONE YEAR USE/PEAK	408.414 108.881	275.557 216.188

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE			
IN SITE MBTU -	ELECTRICITY	NATURAL-GAS	
CATEGORY OF USE			
SPACE HEAT	10.72	275.56	
SPACE COOL	76.93	0.00	
HVAC AUX	86.62	0.00	
DOM HOT WTR	0.00	0.00	
AUX SOLAR	0.00	0.00	
LIGHTS	152.87	0.00	
VERT TRANS	0.00	0.00	
MISC EQUIP	81.27	0.00	
TOTAL	408.42	275.56	

TOTAL SITE ENERGY 683.97 MBTU 146.6 KBTU/SQFT-YR GROSS-AREA 146.6 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1502.03 MBTU 321.9 KBTU/SQFT-YR GROSS-AREA 321.9 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 3.3
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR ZONE #1 TOPEKA, KS

MONTH	COOLING				MAXIMUM COOLING LOAD (KBTU/HR)	HEATING				MAXIMUM HEATING LOAD (KBTU/HR)	ELEC		
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				0.000	-6.465	4	3	8.F	7.F	-41.538	1515.	3.046
FEB	0.00000				0.000	-4.102	2	3	13.F	11.F	-30.609	1367.	3.038
MAR	0.00000				0.000	-3.097	3	4	16.F	13.F	-32.046	1511.	3.042
APR	0.00000				0.000	-0.549	5	5	31.F	29.F	-13.283	1452.	3.028
MAY	6.33590	16	2	62.F	59.F	0.000					0.000	2399.	8.633
JUN	13.15873	19	17	87.F	76.F	0.000					0.000	3316.	8.124
JUL	15.94538	1	16	86.F	80.F	0.000					0.000	3699.	9.106
AUG	16.51320	24	17	95.F	77.F	0.000					0.000	3828.	9.487
SEP	11.49475	5	17	90.F	77.F	0.000					0.000	3093.	9.421
OCT	0.33787	1	17	85.F	68.F	-0.117	31	7	43.F	39.F	-13.730	1546.	7.564
NOV	0.00000				0.000	-1.000	2	4	17.F	15.F	-18.416	1459.	3.029
DEC	0.00000				0.000	-5.796	14	7	10.F	8.F	-30.497	1514.	3.044
TOTAL	63.786					-21.126						26699.	9.487
MAX					59.468						-41.538		

D1-28

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR ZONE #1 TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING LOAD	HEATING LOAD	COINCIDENT COOL-HEAT LOAD	NUMBER OF HOURS	COOLING AVAIL.	HEATING AVAIL.	COINCIDENT COOL-HEAT LOAD	NUMBER OF HOURS	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)		
JAN	0	499	0	245	744	0	744	0	0.000	0.050	0.000	0.050
FEB	0	426	0	246	672	0	672	0	0.000	0.050	0.000	0.050
MAR	0	309	0	435	744	0	744	0	-5.824	0.055	0.000	0.055
APR	0	88	0	632	720	0	720	0	0.000	0.050	0.000	0.050
MAY	366	0	0	378	360	384	744	0	0.000	6.050	0.000	6.050
JUN	708	0	0	12	0	720	720	0	0.000	8.124	0.000	8.124
JUL	744	0	0	0	0	744	744	0	0.000	8.315	0.000	8.315
AUG	744	0	0	0	0	744	744	0	0.000	9.487	0.000	9.487
SEP	644	0	0	76	0	720	720	0	0.000	9.325	0.000	9.325
OCT	16	20	0	708	720	24	744	0	0.000	7.564	0.000	7.564
NOV	0	128	0	592	720	0	720	0	-6.645	0.056	0.000	0.056
DEC	0	490	0	254	744	0	744	0	-9.749	0.058	0.000	0.058
ANNUAL	3222	1960	0	3578	5424	3336	8760	0				

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR ZONE_#2 TOPEKA, KS

MONTH	COOLING				MAXIMUM COOLING LOAD (KBTU/HR)	HEATING				MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRIC					
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		TRICAL ENERGY (KWH)	ELEC LOAD (KW)	MAXIMUM ELEC LOAD			
JAN	0.00000				0.000					-4.038	4 3	8. F	7. F	-32.541	2508.	9.867
FEB	0.00000				0.000					-2.081	2 3	13. F	11. F	-23.751	2264.	9.862
MAR	0.00000				0.000					-1.091	3 4	16. F	13. F	-24.578	2505.	9.862
APR	0.00000				0.000					-0.023	1 4	40. F	36. F	-5.143	2415.	9.862
MAY	7.90755	16 4	60. F	58. F	78.780					0.000				0.000	3572.	16.156
JUN	15.53830	19 19	86. F	75. F	51.151					0.000				0.000	4552.	15.802
JUL	17.62762	2 19	84. F	77. F	50.984					0.000				0.000	4891.	15.969
AUG	17.34673	24 19	92. F	76. F	53.226					0.000				0.000	4929.	16.104
SEP	12.40501	5 19	87. F	76. F	51.071					0.000				0.000	4190.	15.756
OCT	0.33720	1 18	83. F	68. F	38.998					-0.016	2 5	55. F	53. F	-5.415	2544.	14.171
NOV	0.00000				0.000					-0.207	2 5	16. F	15. F	-12.883	2422.	9.862
DEC	0.00000				0.000					-3.115	15 5	8. F	7. F	-24.172	2508.	9.866
TOTAL	71.162				78.780					-10.571					39300.	
MAX																16.156

D1-29

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR ZONE_#2 TOPEKA, KS

MONTH	HOURS				N U M B E R O F				H O U R S				---COINCIDENT LOADS---			
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS COINCIDENT LOAD	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE	HOURS FANS ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		
JAN	0	395	0	0	349	744	0	744	0	349	0.000	0.050	0.000	0.050		
FEB	0	290	0	0	382	672	0	672	0	382	0.000	0.050	0.000	0.050		
MAR	0	141	0	0	603	744	0	744	0	603	0.000	0.050	0.000	0.050		
APR	0	7	0	0	713	720	0	720	0	713	0.000	0.050	0.000	0.050		
MAY	379	0	0	0	365	360	384	744	0	365	0.000	7.776	0.000	7.776		
JUN	717	0	0	0	3	0	720	720	0	3	0.000	15.552	0.000	15.552		
JUL	744	0	0	0	0	0	744	744	0	0	0.000	15.388	0.000	15.388		
AUG	744	0	0	0	0	0	744	744	0	0	0.000	16.104	0.000	16.104		
SEP	673	0	0	0	47	0	720	720	0	47	0.000	15.587	0.000	15.587		
OCT	18	4	0	0	722	720	24	744	0	722	0.000	14.171	0.000	14.171		
NOV	0	46	0	0	674	720	0	720	0	674	-4.064	0.053	-4.064	0.053		
DEC	0	353	0	0	391	744	0	744	0	391	-4.395	0.054	-4.395	0.054		
ANNUAL	3275	1236	0	0	4249	5424	3336	8760	0	4249						

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1												
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION												
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR ZONE #3 TOPEKA, KS												
----- C O O L I N G ----- H E A T I N G ----- E L E C -----												
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-	
											TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-2.108	4	3	8.F	7.F	1922.	3.367
FEB	0.00000				0.000	-0.956	1	23	17.F	15.F	1736.	3.364
MAR	0.00000				0.000	-0.748	3	4	16.F	13.F	1921.	3.366
APR	0.00000				0.000	-0.019	1	4	40.F	36.F	1850.	3.360
MAY	6.16714	16	4	60.F	58.F	0.000				0.000	2680.	8.285
JUN	11.82910	19	17	87.F	76.F	0.000				0.000	3343.	6.976
JUL	13.72206	1	16	86.F	80.F	0.000				0.000	3612.	7.459
AUG	13.76612	24	19	92.F	76.F	0.000				0.000	3664.	7.713
SEP	10.16607	5	17	90.F	77.F	0.000				0.000	3177.	7.654
OCT	0.28569	1	17	85.F	68.F	-0.004	2	5	55.F	53.F	-1.852	6.188
NOV	0.00000				0.000	0.000				0.000	1857.	3.359
DEC	0.00000				0.000	-1.493	8	13	20.F	17.F	1922.	3.367
TOTAL	55.936					-5.328					29637.	
MAX					54.976					-23.633		8.285

D1-30

EMC		ENGINEERS		INC.		EDOE - ELITE SOFTWARE DEVELOPMENT INC		DOE-2.1D		2/ 4/1995		9:27:18		SDL RUN 1	
DENVER,		CO		80227		PROPOSED MODIFICATION FOR BLDG. #5000		FIRE STATION							
REPORT- SS-C		SYSTEM MONTHLY LOAD HOURS FOR		ZONE #3		TOPEKA, KS									
----- N U M B E R O F H O U R S ----- --COINCIDENT LOADS--															
HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HEATING		ELECTRIC	
COOLING		COOL-HEAT		COOLING		COOLING		FANS ON		FANS ON		LOAD AT		LOAD AT	
LOAD		LOAD		AVAIL.		AVAIL.		CYCLE ON		VENTING		COOLING		COOLING	
												PEAK		PEAK	
												(KBTU/HR)		(KW)	
MONTH	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD
JAN	0	281	0	463	744	0	744	0	463	0	0	0.000	1.030	0.000	1.030
FEB	0	199	0	473	672	0	672	0	473	0	0	0.000	1.030	0.000	1.030
MAR	0	138	0	606	744	0	744	0	606	0	0	0.000	1.030	0.000	1.030
APR	0	11	0	709	720	0	720	0	709	0	0	0.000	1.030	0.000	1.030
MAY	384	0	0	360	360	384	744	0	360	0	0	0.000	6.197	0.000	6.197
JUN	720	0	0	0	0	720	720	0	0	0	0	0.000	6.976	0.000	6.976
JUL	744	0	0	0	0	744	744	0	0	0	0	0.000	7.092	0.000	7.092
AUG	744	0	0	0	0	744	744	0	0	0	0	0.000	7.662	0.000	7.662
SEP	712	0	0	8	720	720	720	0	8	0	0	0.000	7.559	0.000	7.559
OCT	24	3	0	717	720	24	744	0	717	0	0	0.000	6.188	0.000	6.188
NOV	0	0	0	720	720	0	720	0	720	0	0	0.000	1.030	0.000	1.030
DEC	0	220	0	524	744	0	744	0	524	0	0	0.000	1.030	0.000	1.030
ANNUAL	3328	852	0	4580	5424	3336	8760	0	4580	0	0				

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY TOTAL(MBTU) PEAK(KBTU) DY/HR	NATURAL-GAS TOTAL(MBTU) PEAK(KBTU) DY/HR
JAN	20.301 55.568 14/12	21.376 143.380 4/ 3	
FEB	18.325 55.490 8/12	13.058 106.222 2/ 3	
MAR	20.274 55.514 13/12	9.599 112.310 3/ 4	
APR	19.519 55.473 4/12	2.703 31.580 5/ 5	
MAY	29.537 112.486 16/12	1.786 2.400 31/ 1	
JUN	38.280 103.401 19/19	1.728 2.400 30/ 1	
JUL	41.664 108.516 23/18	1.786 2.400 31/ 1	
AUG	42.414 112.659 24/19	1.786 2.400 31/ 1	
SEP	35.715 110.535 5/18	1.728 2.400 30/ 1	
OCT	20.625 93.906 1/18	2.016 26.008 2/ 5	
NOV	19.592 55.484 1/12	3.703 50.330 2/ 4	
DEC	20.295 55.541 29/12	18.116 105.566 8/10	
	ONE YEAR USE/PEAK	326.541 112.659	79.383 143.380

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	0.00	79.38
SPACE COOL	83.40	0.00
HVAC AUX	8.99	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	152.87	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	81.27	0.00
TOTAL	326.52	79.38

TOTAL SITE ENERGY 405.92 MBTU 87.0 KBTU/SQFT-YR GROSS-AREA 87.0 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1059.99 MBTU 227.1 KBTU/SQFT-YR GROSS-AREA 227.1 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.4
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

G21Q "PULSE21"™ SERIES UP-FLO GAS FURNACES

*93.2% to 96.2% A.F.U.E.

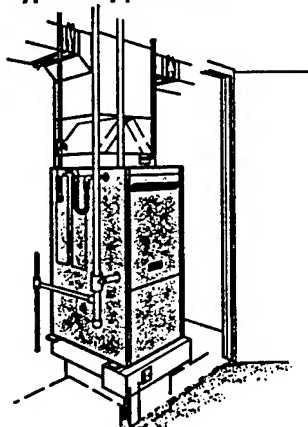
40,000 to 100,000 Btuh Input

Add-On Cooling — 1-1/2 thru 5 Nominal Tons

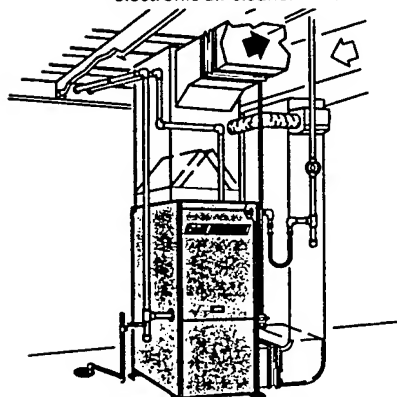
*Isolated Combustion System Rating for Non-Weatherized Furnaces



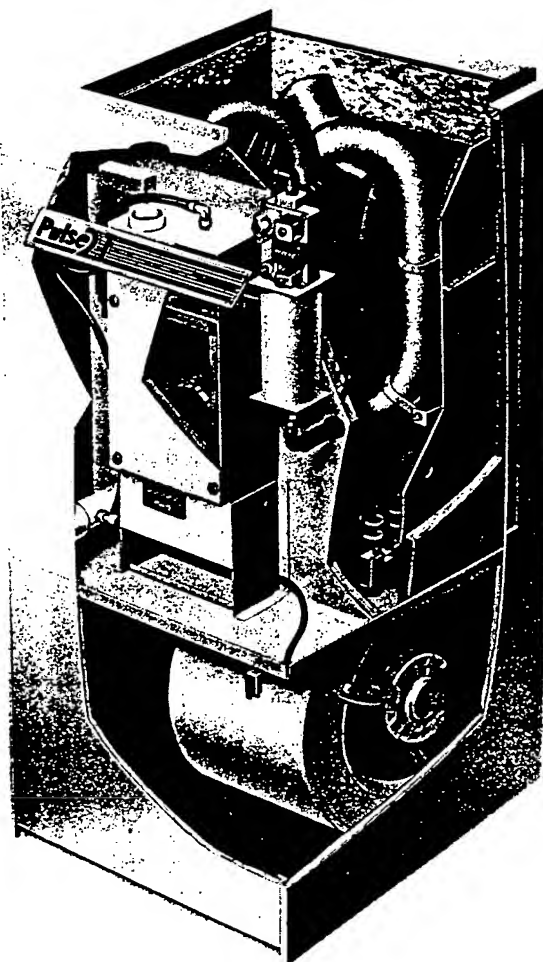
Typical Applications



Closet Installation
With cooling coil and
electronic air cleaner



Utility Room Installation
With cooling coil, return air
cabinet and humidifier



G-14

Application — Lennox G21 series gas furnaces are available in eight models (natural gas or LPG) with input capacities of 40,000, 60,000, 80,000 and 100,000 Btuh. Units operate on the pulse combustion principle and do not require conventional pilot burner, main burners, flue or chimney. Standard size cabinet with side or bottom return air entry permits installation in a basement, utility room or closet. Lennox add-on evaporator coils, electronic air cleaners and power humidifiers can easily be added for a total comfort all-season system. Replacement of furnaces manufactured by Lennox in the last twenty-five years can be done with only minor modification to duct work or add-on coils.

High efficiency of the G21 series is achieved with a unique heat exchanger design which features: finned cast iron combustion chamber, temperature resistant steel tailpipe, aluminized steel exhaust decoupler section and a finned stainless steel tube condenser coil. Moisture, during the process of combustion, is condensed in the coil, extracting almost every usable Btu out of the gas. Most of the combustion heat is utilized in the heat transfer from the coil, producing flue vent temperatures as low as 100F to 130F which allows the use of PVC (polyvinyl chloride) pipe for venting. Furnace can be vented through a side wall, roof or to the top of an existing chimney with up to 35 ft. of PVC pipe and up to four 90 degree elbows. Condensate created in the coil (PH ranges from 4.0 to 6.0) is not harmful to standard household plumbing and can be drained into city sewers and septic tanks without damage.

The G21 furnace has no pilot light or burners. An automotive type spark plug is used for ignition on the initial cycle only, saving gas and electrical energy. In the pulse combustion process, the use of atmospheric burners is eliminated, with combustion confined to heat exchanger combustion chamber. Sealed combustion system virtually eliminates the loss of conditioned air due to combustion and stack dilution. Combustion air is piped to the furnace with same type PVC pipe as used for exhaust gases.

Furnace is equipped with standard type redundant gas valve in series with gas expansion tank and gas intake flapper valve. Also factory installed are an air intake flapper valve, purge blower, spark plug igniter, flame sensor with solid-state control, solid-state blower control, limit control, high and low voltage terminal strip, 30VA transformer and cleanable air filter. Furnished for field installation are a flexible gas line connector, (4) isolation mounting pads, base insulation pad and condensate drip leg.

Optional equipment available: flue vent/air intake line roof or wall termination installation kits, LPG conversion kits, mufflers, furnace twinning kit, continuous low speed blower kit, external filter mounting kit and thermostat.

G21 units are shipped completely factory assembled with all controls installed and wired. Units are test fired at the factory before shipment.

Zone #3

SPECIFICATIONS

Model No.		G21Q3-40	G21Q3-60	G21Q4-60
Input Btuh		40,000	60,000	60,000
Output Btuh		38,000	55,000	55,000
*A.F.U.E.		96.2%	94.1%	94.1%
California Seasonal Efficiency		90.7%	89.9%	88.8%
Temperature rise range (°F)		35 — 65	40 — 70	35 — 65
High static certified by A.G.A. (in wg.)		.50	.50	.50
Gas Piping Size I.P.S. (in.)	Natural	1/2	1/2	1/2
	**LPG	1/2	1/2	1/2
Vent/Intake air pipe size connection (in.)		2	2	2
Condensate drain connection (in.) SDR11		1/2	1/2	1/2
Blower wheel nominal diameter x width (in.)		10 x 8	10 x 8	11 x 9
Blower motor hp		1/3	1/3	1/2
Number and size of filters (in.)		(1) 16 x 25 x 1	(1) 16 x 25 x 1	(1) 16 x 25 x 1
Tons of cooling that can be added		1-1/2 — 3	1-1/2 — 3	2-1/2 — 4
Shipping weight (lbs.)		250	250	255
Number of packages in shipment		1	1	1
Electrical characteristics		120 volts — 60 hertz — 1 phase (less than 12 amps) All models		
**LPG kit (optional)		LB-83176CR (76H95)	LB-83176CE (66H97)	LB-83176CE (66H97)
Cont. Low Speed Blower Switch Kit (optional)		LB-83611A (90H79) (All models — not used with twinning kit)		
Furnace Twinning Kit (optional)		LB-63093CA (64H88) (All models)		
Cont. Low Speed Blower Switch (optional)		67H18 (All models — used with twinning kit only)		
External Filter Mounting Kit (optional)	Part No.	LB-81871CA (16H36)	LB-81871CA (16H36)	LB-81871CA (16H36)
	•Filter size (in.)	(1) 16 x 25 x 1	(1) 16 x 25 x 1	(1) 16 x 25 x 1

*Filter is not furnished with kit. Filter kit utilizes existing filter supplied with G21 unit.

*Annual Fuel Utilization Efficiency based on D.O.E. test procedures and according to F.T.C. labeling regulations. Isolated combustion system rating for non-weatherized furnaces.

**LPG kit must be ordered extra for field changeover.

Zone #1 \$2,680 LIST = \$2,145

SPECIFICATIONS

Model No.		G21Q3-80	G21Q4-80	G21Q5-80	G21Q3-100	G21Q4/5-100
Input Btuh		80,000	80,000	80,000	100,000	100,000
Output Btuh		73,000	73,000	74,000	93,000	95,000
*A.F.U.E.		93.9%	93.9%	93.2%	94.0%	94.5%
California Seasonal Efficiency		90.1%	88.9%	88.3%	90.8%	89.6%
Temperature rise range (°F)		45 — 75	40 — 70	35 — 65	55 — 85	40 — 70
High static certified by A.G.A. (in wg.)		.50	.50	.50	.50	.50
Gas Piping Size I.P.S. (in.)	Natural	1/2	1/2	1/2	1/2	1/2
	**LPG	1/2	1/2	1/2	1/2	1/2
Vent/Intake air pipe size connection (in.)		2	2	2	2	2
Condensate drain connection (in.) SDR11		1/2	1/2	1/2	1/2	1/2
Blower wheel nominal diameter x width (in.)		10 x 8	11 x 9	12 x 12	10 x 8	12 x 12
Blower motor hp		1/3	1/2	3/4	1/2	3/4
Number and size of filters (in.)		(1) 16 x 25 x 1	(1) 16 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1
Tons of cooling that can be added		2 — 3	2-1/2 — 4	4 or 5	2 — 3	3-1/2 — 5
Shipping weight (lbs.)		250	255	297	297	297
Number of packages in shipment		1	1	1	1	1
Electrical characteristics		120 volts — 60 hertz — 1 phase (less than 12 amps) All models				
**LPG kit (optional)		LB-83176CF (66H98)	LB-83176CF (66H98)	LB-83176CF (66H98)	LB-83176CP (73H62)	LB-83176CP (73H62)
Cont. Low Speed Blower Switch Kit (optional)		LB-83611A (90H79) (All models — not used with twinning kit)				
Furnace Twinning Kit (optional)		LB-63093CA (64H88) (All models)				
Cont. Low Speed Blower Switch (optional)		67H18 (All models — used with twinning kit only)				
External Filter Mounting Kit (optional)	Part No.	LB-81871CA (16H36)	LB-81871CA (16H36)	LB-81871CB (16H37)	LB-81871CB (16H37)	LB-81871CB (16H37)
	•Filter size (in.)	(1) 16 x 25 x 1	(1) 16 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1

*Filter is not furnished with kit. Filter kit utilizes existing filter supplied with G21 unit.

*Annual Fuel Utilization Efficiency based on D.O.E. test procedures and according to F.T.C. labeling regulations. Isolated combustion system rating for non-weatherized furnaces.

**LPG kit must be ordered extra for field changeover.

BLOWER DATA

**G21Q3-40, G21Q3-60 AND G21Q3-80
BLOWER PERFORMANCE**

External Static Pressure (in. wg)	Air Volume @ Various Speeds		
	High	Medium	Low
0	1585	1392	920
.05	1558	1364	917
.10	1533	1354	915
.15	1505	1335	912
.20	1477	1315	905
.25	1447	1294	893
.30	1418	1272	887
.40	1355	1225	858
.50	1282	1164	803

NOTE — All cfm data is measured external to unit with the air filter in place.

**G21Q4-60 AND G21Q4-80
BLOWER PERFORMANCE**

External Static Pressure (in. wg)	Air Volume @ Various Speeds		
	High	Medium	Low
0	1793	1295	1050
.05	1770	1290	1050
.10	1747	1285	1050
.15	1724	1280	1050
.20	1700	1275	1050
.25	1675	1267	1050
.30	1648	1258	1050
.40	1585	1233	1036
.50	1517	1193	1012

NOTE — All cfm data is measured external to unit with the air filter in place.

G21Q5-80 BLOWER PERFORMANCE

External Static Pressure (in. wg)	Air Volume (cfm) @ Various Speeds				
	High	Med-High	Medium	Med-Low	Low
0	2460	2350	2155	1900	1695
.05	2430	2310	2130	1875	1675
.10	2395	2275	2100	1855	1655
.15	2355	2240	2065	1825	1625
.20	2315	2205	2035	1800	1600
.25	2275	2175	1995	1780	1570
.30	2235	2130	1960	1740	1540
.40	2155	2055	1880	1675	1480
.50	2070	1970	1790	1605	1410
.60	1980	1890	1710	1540	1345

NOTE — All cfm data is measured external to unit with the air filter in place.

G21Q3-100 BLOWER PERFORMANCE

External Static Pressure (in. wg)	Air Volume @ Various Speeds		
	High	Medium	Low
0	1850	1660	1500
.05	1805	1635	1470
.10	1760	1610	1440
.15	1720	1575	1420
.20	1680	1540	1400
.25	1635	1505	1375
.30	1590	1470	1350
.40	1500	1400	1290
.50	1400	1320	1220
.60	1290	1230	1140

NOTE — All cfm data is measured external to unit with the air filter in place.

G21Q4/5-100 BLOWER PERFORMANCE

External Static Pressure (in. wg)	Air Volume (cfm) @ Various Speeds				
	High	Med-High	Medium	Med-Low	Low
0	2450	2340	2140	1910	1690
.05	2420	2310	2110	1880	1670
.10	2390	2270	2080	1860	1640
.15	2350	2240	2050	1830	1620
.20	2320	2210	2020	1800	1590
.25	2280	2170	1990	1770	1570
.30	2250	2140	1960	1740	1540
.40	2180	2060	1890	1680	1480
.50	2100	1980	1810	1610	1420
.60	2005	1890	1740	1530	1350

NOTE — All cfm data is measured external to unit with the air filter in place.





HS14 POWER SAVER® SERIES CONDENSING UNITS

*32,800 to 64,500 Btuh Cooling Capacity
*ARI Standard 210/240 and DOE Ratings

ENGINEERING DATA
COOLING UNITS
CONDENSING UNITS

Page 20

July 1991

Supersedes

August 1990



CERTIFICATION APPLIES ONLY
WHEN THE COMPLETE
SYSTEM IS LISTED
WITH ARI

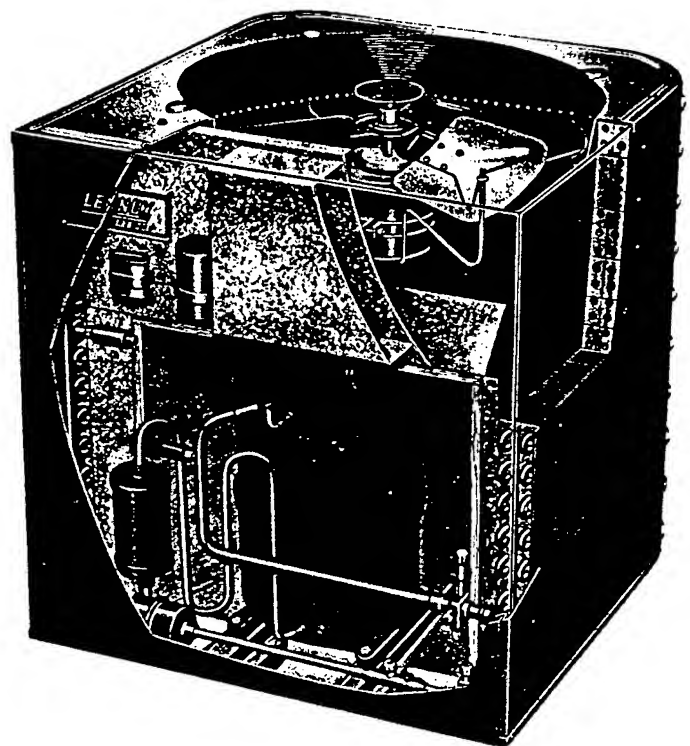


CERTIFICATION APPLIES ONLY
WHEN THE COMPLETE
SYSTEM IS LISTED
WITH ARI

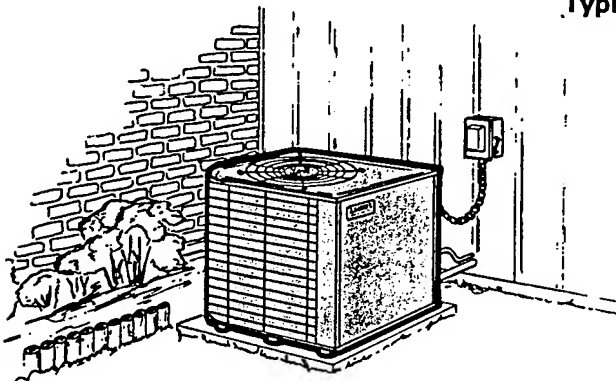
Application — The HS14 POWER SAVER line of remote condensing units offer seasonal energy efficiency ratios (SEER's) of up to 15.5 in 3, 4 and 5 ton sizes with a choice of single or three phase voltage power supply. These super efficient units are equipped with a two-speed compressor staged to deliver the precise cooling capacity desired with minimum operating costs. Compressor operates on low speed under light and medium loads and goes to high speed for heavy cooling loads. Vertical discharge of air allows concealment of the unit among shrubs on a slab at grade level or out of sight on a roof. A variety of matching blower powered or furnace add-on evaporator units provide a wide range of cooling capacities and application versatility. See ARI Ratings table. For evaporator unit data see tab section Coils-Blower Coil Units. Condensing units are shipped factory assembled, piped and wired. In addition, the units are test operated at the factory to ensure dependable, on the job performance. The installer has only to connect the refrigerant lines and make electrical connections.

Approvals — Condensing units have been tested with matching evaporator units in the Lennox Research Laboratory environmental test room and rated according to U.S. Department of Energy (DOE) test procedures and in accordance with ARI Standard 210/240-89. In addition, units have been sound rated in the Lennox reverberant sound test room in accordance with ARI Standard 270-84. Condensing units and components within are bonded for grounding to meet safety standards for servicing required by U.L. and N.E.C. Units are also U.L. Listed.

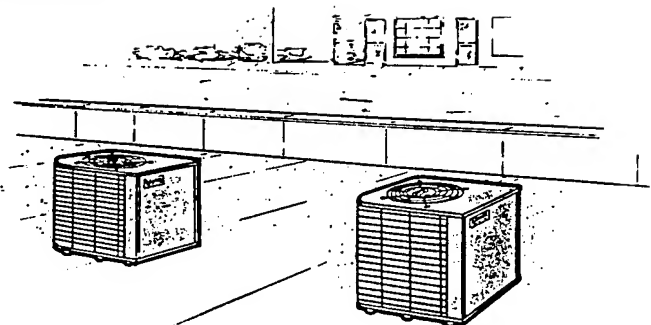
Equipment Warranty — The compressor has a limited warranty for a full ten years in residential installations and five years in non-residential installations. All other components have a limited warranty for one year. Refer to Lennox Equipment Limited Warranty certificate included with the unit for specific details.



Typical Applications



Unit on slab at ground level.



Multiple units on rooftop

NOTE — Specifications, Ratings and Dimensions subject to change without notice.

D1-37

©1991 Lennox Industries Inc.



HS14 SERIES CONDENSING UNITS **ARI/COOLING CAPACITY RATINGS WITH** **CH20-51 & CH20-65 EVAPORATOR UNITS**

SUPPLEMENTAL
ENGINEERING DATA

COOLING UNITS
CONDENSING UNITS

Page 20bb

July 1991

ARI RATINGS

Condensing Unit Model No. *ARI Standard 270 SRN (bels)	**ARI Standard 210/240 Ratings				Evaporator Unit			***Expansion Valve Kit
	SEER (Btuh/ Watts)	EER (Btuh/ Watts)	Cooling Capacity (Btuh)	Total Unit Watts	Up-Flo	Down-Flo	Horizontal	
HS14-411V-413V (7.6)	12.70	9.85	40,000	4060	----	----	CH20-51	LB-53081CA
HS14-511V-513V (7.6)	12.10	9.15	47,500	5175	----	----	CH20-51	LB-53081CB
HS14-511V-513V (7.6)	12.30	9.20	50,500	5480	----	----	CH20-65	LB-53081CB
HS14-651V-653V (7.8)	11.70	8.45	56,000	6610	----	----	CH20-51	LB-53081CC
HS14-651V-653V (7.8)	11.30	8.65	60,000	6945	----	----	CH20-65	LB-53081CC

*Sound Rating Number in accordance with ARI Standard 270.

**Rated in accordance with ARI Standard 210/240 and DOE; 95F outdoor air temperature, 80F db / 67F wb entering evaporator air with 25 ft. of connecting refrigerant lines.

***Kit is optional and must be ordered extra for field installation.

RATINGS

NOTE — To determine Sensible Capacity, Leaving Wet and Dry Bulb temperatures not shown in the tables, see Miscellaneous Engineering Data section, page 9.

HS14-411V-413V WITH CH20-51 EVAPORATOR UNIT **(Low Speed Compressor Operation)**

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																							
		75						85						95						105					
		Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)						
				Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)						
				75	80	85			75	80	85			75	80	85			75	80	85	75	80	85	
63	1200	27,000	1300	.87	1.00	1.00	25,500	1460	.90	1.00	1.00	24,100	1620	.93	1.00	1.00	22,500	1790	.96	1.00	1.00				
	1600	28,700	1280	.95	1.00	1.00	27,100	1450	.97	1.00	1.00	25,400	1630	1.00	1.00	1.00	23,600	1810	1.00	1.00	1.00				
	2000	29,800	1280	1.00	1.00	1.00	28,000	1450	1.00	1.00	1.00	26,200	1630	1.00	1.00	1.00	24,100	1810	1.00	1.00	1.00				
67	1200	28,300	1290	.67	.85	1.00	26,500	1450	.68	.88	1.00	24,700	1630	.69	.90	1.00	23,000	1800	.70	.94	1.00				
	1600	29,200	1280	.70	.95	1.00	27,400	1450	.72	.96	1.00	25,600	1630	.73	.98	1.00	23,600	1810	.74	1.00	1.00				
	2000	29,800	1280	.73	1.00	1.00	28,000	1450	.75	1.00	1.00	26,200	1630	.76	1.00	1.00	24,100	1810	.79	1.00	1.00				
71	1200	29,600	1280	.48	.67	.83	27,800	1450	.47	.68	.85	25,900	1630	.47	.69	.88	24,000	1810	.48	.70	.92				
	1600	30,600	1270	.48	.71	.91	28,600	1450	.49	.72	.95	26,400	1630	.49	.73	.98	24,300	1810	.49	.75	1.00				
	2000	31,100	1270	.49	.74	.98	28,800	1450	.51	.75	1.00	26,600	1630	.50	.77	1.00	24,400	1810	.51	.81	1.00				

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

HS14-411V-413V WITH CH20-51 EVAPORATOR UNIT **(High Speed Compressor Operation)**

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																							
		85						95						105						115					
		Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)						
				Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)						
				75	80	85			75	80	85			75	80	85			75	80	85				
63	1200	41,300	3030	.73	.87	.98	39,300	3240	.76	.88	1.00	37,300	3450	.77	.90	1.00	35,100	3640	.78	.93	1.00				
	1600	43,700	3100	.79	.93	1.00	41,700	3320	.80	.95	1.00	39,200	3530	.82	.98	1.00	37,000	3740	.83	1.00	1.00				
	2000	45,200	3140	.83	.99	1.00	42,900	3370	.84	1.00	1.00	40,700	3600	.86	1.00	1.00	38,400	3820	.88	1.00	1.00				
67	1200	43,500	3100	.58	.70	.84	41,400	3310	.58	.72	.85	39,100	3530	.60	.75	.87	37,000	3740	.62	.76	.89				
	1600	45,900	3160	.62	.77	.90	43,600	3390	.63	.78	.92	41,200	3620	.63	.80	.95	38,800	3840	.64	.81	.98				
	2000	47,600	3200	.64	.81	.97	45,100	3440	.64	.82	.99	42,500	3680	.65	.84	1.00	39,800	3900	.66	.86	1.00				
71	1200	45,700	3150	.44	.56	.68	43,300	3380	.44	.57	.69	40,900	3610	.44	.58	.71	38,600	3830	.46	.61	.74				
	1600	47,600	3210	.45	.60	.75	45,300	3450	.46	.62	.76	42,700	3690	.46	.62	.78	40,100	3910	.46	.63	.79				
	2000	49,100	3250	.46	.63	.79	46,600	3490	.46	.64	.81	43,800	3730	.47	.65	.82	41,000	3950	.46	.66	.85				

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

D1-38

RATINGS

NOTE — To determine sensible capacity, leaving wet bulb and dry bulb temperatures not shown in the tables, see Miscellaneous Engineering Data, page 9.

HS14-651V-653V WITH CH16-51FF EVAPORATOR UNIT

(Low Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																			
		75						85					95					105			
		Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)		
				Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)		
				75	80	85			75	80	85			75	80	85			75	80	85
63	1500	39,500	2020	.77	.95	1.00	37,600	2320	.79	.98	1.00	35,800	2640	.81	1.00	1.00	34,000	2990	.83	1.00	1.00
	2000	42,400	1990	.85	1.00	1.00	40,600	2300	.88	1.00	1.00	38,700	2650	.92	1.00	1.00	36,700	3020	.96	1.00	1.00
	2500	44,900	1960	.91	1.00	1.00	42,900	2290	.98	1.00	1.00	40,700	2650	1.00	1.00	1.00	38,500	3030	1.00	1.00	1.00
67	1500	41,900	1990	.59	.75	.90	40,000	2300	.60	.76	.93	37,800	2650	.62	.78	.97	35,600	3010	.63	.81	1.00
	2000	44,200	1970	.64	.83	1.00	42,100	2290	.66	.85	1.00	39,700	2640	.69	.88	1.00	37,400	3030	.70	.92	1.00
	2500	45,700	1950	.70	.92	1.00	43,200	2280	.72	.96	1.00	41,000	2640	.74	.98	1.00	38,500	3040	.76	1.00	1.00
71	1500	44,600	1970	.43	.58	.72	42,500	2280	.44	.59	.74	40,200	2640	.44	.60	.76	37,800	3030	.45	.62	.78
	2000	46,900	1940	.45	.67	.80	44,400	2270	.46	.65	.82	41,900	2640	.47	.67	.85	39,400	3050	.48	.69	.89
	2500	48,100	1930	.48	.69	.89	45,500	2270	.50	.71	.92	43,000	2650	.50	.73	.96	40,400	3060	.51	.75	.99

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

HS14-651V-653V WITH CH16-51FF EVAPORATOR UNIT

(High Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																			
		85					95					105					115				
		Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)		
				Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)		
				75	80	85			75	80	85			75	80	85			75	80	85
63	1500	59,000	5560	.67	.79	.92	56,200	5990	.68	.81	.94	53,400	6420	.69	.83	.96	50,400	6830	.71	.86	.99
	2000	63,500	5710	.72	.87	1.00	60,400	6170	.74	.89	1.00	57,300	6620	.76	.92	1.00	53,700	7060	.78	.95	1.00
	2500	66,200	5810	.77	.94	1.00	63,300	6290	.79	.97	1.00	59,700	6760	.82	.99	1.00	56,300	7230	.85	1.00	1.00
67 →	1500	62,900	5690	.54	.64	.75	60,000	6140	.54	.65	.77	56,900	6600	.55	.67	.79	53,700	7050	.56	.68	.82
	2000	67,300	5840	.56	.69	.83	63,900	6320	.57	.71	.85	60,500	6800	.58	.73	.88	57,000	7280	.60	.75	.91
	2500	70,100	5940	.59	.75	.91	66,700	6440	.60	.77	.93	63,200	6950	.62	.79	.96	59,500	7440	.63	.82	.99
71	1500	66,800	5820	.41	.52	.62	63,700	6300	.42	.52	.63	60,400	6790	.42	.53	.64	57,200	7280	.42	.54	.66
	2000	71,400	5980	.42	.55	.67	67,900	6490	.43	.56	.68	64,300	7010	.43	.57	.70	60,600	7520	.44	.58	.72
	2500	74,300	6080	.44	.58	.72	70,700	6610	.44	.59	.74	66,800	7150	.45	.61	.76	62,900	7670	.45	.62	.79

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

HS14-651V-653V WITH CR16-51FF EVAPORATOR UNIT

(Low Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																			
		75					85					95					105				
		Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)		
				Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)		
				75	80	85			75	80	85			75	80	85			75	80	85
63	1500	36,400	2040	.73	.90	1.00	34,600	2330	.75	.92	1.00	32,600	2630	.76	.96	1.00	30,900	2940	.78	.98	1.00
	2000	38,700	2030	.79	.99	1.00	36,900	2320	.81	1.00	1.00	35,200	2640	.84	1.00	1.00	33,400	2980	.87	1.00	1.00
	2500	40,900	2000	.86	1.00	1.00	39,100	2310	.89	1.00	1.00	37,300	2650	.92	1.00	1.00	35,300	3000	.96	1.00	1.00
67	1500	38,900	2030	.57	.71	.85	37,100	2320	.58	.72	.87	35,100	2640	.59	.74	.90	33,000	2970	.60	.76	.94
	2000	41,100	2000	.61	.76	.95	39,100	2310	.62	.78	.98	36,900	2650	.63	.81	1.00	34,600	3000	.64	.84	1.00
	2500	42,600	1990	.64	.83	1.00	40,400	2300	.65	.86	1.00	38,200	2650	.67	.89	1.00	35,500	3010	.68	.93	1.00
71	1500	41,600	2000	.43	.56	.68	39,600	2310	.43	.57	.69	37,500	2650	.44	.58	.71	35,300	3000	.44	.59	.73
	2000	43,700	1980	.44	.60	.74	41,600	2290	.45	.61	.76	39,400	2640	.45	.62	.78	37,000	3020	.46	.63	.81
	2500	45,400	1950	.46	.63	.80	43,100	2280	.46	.64	.83	40,600	2640	.47	.66	.86	38,100	3040	.48	.68	.89

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

HS14-651V-653V WITH CR16-51FF EVAPORATOR UNIT

(High Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																							
		85						95						105						115					
		Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T)						
				Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)					Dry Bulb (°F)						
				75	80	85			75	80	85			75	80	85			75	80	85				
63	1500	54,900	5410	.66	.77	.88	52,300	5820	.67	.78	.90	49,600	6210	.68	.80	.92	46,700	6580	.69	.82	.94				
	2000	59,200	5570	.69	.82	.95	56,300	5990	.70	.84	.97	53,200	6410	.72	.86	.99	49,900	6810	.74	.89	1.00				
	2500	62,200	5670	.73	.87	1.00	58,900	6110	.74	.90	1.00	55,900	6540	.76	.92	1.00	52,600	6960	.78	.95	1.00				
67	1500	58,600	5540	.53	.63	.73	55,900	5970	.54	.64	.74	53,000	6400	.54	.65	.76	50,000	6800	.55	.66	.78				
	2000	63,200	5700	.55	.66	.78	60,100	6160	.56	.68	.80	56,900	6610	.57	.69	.82	53,500	7040	.58	.71	.85				
	2500	66,300	5810	.57	.70	.84	63,000	6280	.58	.71	.86	59,500	6750	.59	.73	.88	55,900	7200	.60	.75	.91				
71	1500	62,200	5660	.41	.51	.60	59,400	6120	.41	.52	.61	56,400	6580	.41	.52	.62	53,300	7030	.41	.53	.64				
	2000	67,000	5830	.42	.53	.64	63,800	6320	.42	.54	.65	60,400	6800	.42	.55	.66	56,900	7270	.43	.56	.68				
	2500	70,300	5940	.43	.56	.67	66,800	6450	.43	.57	.69	63,200	6950	.44	.58	.71	59,500	7450	.44	.59	.73				

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd. 9755 Dogwood Rd.
Suite C-200 Suite 220
Denver, CO 80227 Roswell, GA 30075
(303) 988-2951 (404) 642-1864

JOB 1406.005 HVAC Upgrade - Ft Riley, KS
SHEET NO. _____ OF _____
CALCULATED BY C. Wahlen DATE 2/3/95
CHECKED BY _____ DATE _____
SCALE _____

Price Quote for F.A.C.s

Lennox

Contact: Tim Nelson

<u>model No.</u>	<u>List Price</u>	<u>Cooling Capacity</u>	<u>heating capacity</u>
G20 E	\$ 1,840	4 tons	75,000 Btu/h
G21 Q	\$ 2,680	5 tons	80,000 Btu/h
	\$ 2,600	5 tons	60,000 Btu/h

BUILDING 7178 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	411.21	318.98	92.23	51.87
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	90.80	66.55	24.25	13.64
Electric Demand July (KW)	93.67	69.61	24.06	13.53
Electric Demand August (KW)	96.28	67.94	28.34	15.94

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7243 (sq.ft.)	4410
ECO Model Bldg 7178 (sq.ft.)	2480
Square Footage Adjustment Factor	0.562

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 7178 - Replace 3 Window ACs w/ 1SZ AHU

A. CONSTRUCTION COST	=	\$11,220
B. SIOH COST	(5.5% of 1A) =	\$617
C. DESIGN COST	(6.0% of 1A) =	\$673
D. TOTAL COST	(1A + 1B + 1C) =	\$12,511
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$12,511

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	52	\$628	15.88	\$9,967
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	0	\$0	18.30	\$0
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$826	14.88	\$12,293
F. TOTAL		52	\$1,454		-----> \$22,259

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	(\$141)	14.88	(\$2,094)
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	(\$141)		(\$2,094)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$4,071	5	0.863	\$3,513
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$4,071			\$3,513

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$1,419

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$1,517

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 8.25

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$23,679

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 1.89

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF 1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95	
						ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7178							
2		PROPOSED SYSTEM MODIFICATIONS							
3		NEW SYSTEMS INSTALLATION							
4		1,300 CFM AHU	EA.	1.0	\$2,296.53	Q-5	13.9965	\$271	\$2,568
5	AHUH1300	12X6 SA GRILLES	EA.	6.0	\$9.84	1-SHEE	0.348	\$43	\$102
6	12X6SA	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	132.0	\$0.47	Q-10	0.098	\$251	\$313
7	DUCT500	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	\$24.23	1-ELEC	0.8	\$17	\$41
8	E-TSTAT1	COPPER WIRING #12	C.L.F.	0.5	\$7.41	1-ELEC	0.727	\$8	\$11
9	WIRE#12	7.5 TON ACCU	EA.	1.0	\$3,125.03	Q-5	29.091	\$564	\$3,689
10	ACCU7.5	COPPER PIPE TYPE L, 2" W/HANGERS	L.F.	15.0	\$5.96	1-PLUM	0.19	\$61	\$151
11	CUPIP2	VALVES AND FITTINGS ADD 15%						\$9	\$23
12		COPPER PIPE TYPE L, 0.75" W/HANGERS	L.F.	15.0	\$1.84	1-PLUM	0.105	\$34	\$62
13	CUPIP0.75	VALVES AND FITTINGS ADD 15%						\$5	\$9
14		COPPER WIRING #6	C.L.F.	1.0	\$24.71	1-ELEC	1.231	\$26	\$50
15	WIRE#6								
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26		EXISTING SYSTEMS DEMOLITION							
27		WAC REMOVAL	TON	0.8		Q-5	17.778	\$259	\$259
28									
29									
30									
31		SUBTOTAL							
32	OH	OVERHEAD			\$5,729			\$1,549	\$7,278
33	PRO	PROFIT			\$962			\$260	\$1,223
34	CONT	CONTINGENCY			\$669			\$181	\$850
35	TOTAL COST				\$1,472			\$398	\$1,870
					\$8,833			\$2,387	\$11,220

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET 1 OF 1		DATE PREPARED 4-May-95		1	
ENGINEER		E M C Engineers, Inc. Denver, CO		ESTIMATOR		C. Wohler		4-May-95	
				CHECKED BY		A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7178							
2		NON-RECURRING							
3									
4									
5	WAC1.5	EXISTING SYSTEM REPLACEMENT WINDOW AIR CONDITIONER, 1.5 TON	EA.	3.0	\$750.98	L-2	2.667	\$129	\$2,382
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20		EXISTING SYSTEMS DEMOLITION	TON						
21		WAC REMOVAL		0.8		Q-5	17.778	\$259	\$259
22									
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL			\$2,253			\$388	\$2,641
32	OH	OVERHEAD			17%			\$65	\$444
33	PRO	PROFIT			10%			\$45	\$308
34	CONT	CONTINGENCY			20%			\$100	\$679
35		TOTAL COST			\$3,473			\$598	\$4,071

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7178	BLDG 7178						
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-FC	MAINT. ON FCs - INSPEC. / YR	EA.	3.0	\$0.00	Q-6	4	\$241	\$241
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	-	-	\$241	\$241
16									
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
18	MNT-AHU1	MAINT. ON AHU - INSPEC. / YR <= 5000 CFM	EA.	1.0		Q-6	19	\$382	\$382
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	-	-	\$382	\$382
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	-	-	(\$141)	(\$141)

DEMAND LIMITING ANALYSIS BUILDING 7178

	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
SUMMER PEAK (KW) = 27812												
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	28400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	28453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,955.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	13.53	15.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.64
CAPACITY (KW)	32458	34436	26136	20754	26400	22752	27108	25812	23310	21834	21996	30082
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32720	34749	26373	20775	28453	22820	27244	25916	23404	21878	22084	30448
80% SUMMER PEAK (KVA)	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32720	34749	27799	27799	27799	27799	27799	27799	27799	27799	27799	30448
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,086.93	\$138,302.65	\$110,156.12	\$110,156.12	\$110,156.12	\$110,156.12	\$110,156.12	\$110,156.12	\$110,156.12	\$110,156.12	\$110,156.12	\$120,883.33
SUB DISCOUNT \$.20	(\$6,544.05)	(\$6,949.76)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$5,559.81)	(\$6,089.55)
CAPACITY CHARGE	\$126,132.88	\$133,942.89	\$107,186.31	\$107,186.31	\$107,186.31	\$107,186.31	\$107,186.31	\$107,186.31	\$107,186.31	\$107,186.31	\$107,186.31	\$117,383.79
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,197.09	\$68,177.15	\$54,541.72	\$54,541.72	\$54,541.72	\$54,541.72	\$54,541.72	\$54,541.72	\$54,541.72	\$54,541.72	\$54,541.72	\$59,738.46
100*KVA @ \$.03404	\$111,379.66	\$118,284.93	\$94,627.94	\$94,627.94	\$94,627.94	\$94,627.94	\$94,627.94	\$94,627.94	\$94,627.94	\$94,627.94	\$94,627.94	\$103,644.10
250*KVA @ \$.03084	\$252,272.97	\$267,913.27	\$210,024.83	\$184,119.23	\$214,330.62	\$214,330.62	\$214,330.62	\$214,330.62	\$214,330.62	\$212,800.43	\$171,166.43	\$234,752.05
EXCESS @ \$.02864	\$109,745.85	\$65,885.71	\$0.00	\$0.00	\$1,156.57	\$51,849.37	\$42,398.17	\$32,946.97	\$38,961.37	\$0.00	\$0.00	\$28,379.53
ENERGY CHARGE	\$537,595.57	\$520,261.06	\$359,194.49	\$333,288.89	\$364,656.85	\$415,349.65	\$405,898.45	\$396,447.25	\$402,461.65	\$361,970.09	\$320,336.09	\$426,514.13
TOTAL CHARGE LESS ECA	\$663,728.46	\$654,203.95	\$466,380.81	\$440,475.21	\$471,843.16	\$522,535.96	\$513,084.76	\$503,633.56	\$509,647.96	\$469,156.41	\$427,522.41	\$543,897.92
SUMMARY												
MONTHLY DIFFERENCE	\$74.62	\$87.96	\$59.05	\$59.05	\$70.37	\$70.37	\$70.37	\$70.37	\$70.37	\$59.05	\$59.05	\$75.50
ANNUAL DIFFERENCE		\$826.12										

BUILDING 7243 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	411.21	318.98	92.23	49.61
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	90.80	66.55	24.25	13.04
Electric Demand July (KW)	93.67	69.61	24.06	12.94
Electric Demand August (KW)	96.28	67.94	28.34	15.24

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8021 (sq.ft.)	22517.5
ECO Model Bldg 7243 (sq.ft.)	12112.5
Square Footage Adjustment Factor	0.538

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 7243 - Replace 15 Window ACs w/ 5 SZ AHUs

A. CONSTRUCTION COST	=	\$39,099
B. SIOH COST	(5.5% of 1A) =	\$2,150
C. DESIGN COST	(6.0% of 1A) =	\$2,346
D. TOTAL COST	(1A + 1B + 1C) =	\$43,596
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$43,596

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:				<u>JAN '95</u>	
ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	50	\$600	15.88	\$9,532
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	0	\$0	18.30	\$0
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$790	14.88	\$11,758
F. TOTAL		50	\$1,390		-----> \$21,291

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)					
1 ANNUAL MAINTENANCE		(\$704)	14.88	(\$10,471)	
2		\$0	14.88	\$0	
3		\$0	14.88	\$0	
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST		(\$704)		(\$10,471)	
B. NON-RECURRING (+/-)					
ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)	
			(TABLE A-2)		
a. BASELINE EQUIP. REPLCMNT.	\$19,638	5	0.863	\$16,948	
b.				\$0	
c.				\$0	
d.				\$0	
e.				\$0	
f. TOTAL	\$19,638			\$16,948	
C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)			(3A4 + 3Bf4) =		\$6,477

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$1,669
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	26.13
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$27,767
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	0.64
(MUST HAVE SIR > 1.25 TO QUALIFY)		

ENGINEER'S OPINION OF PROBABLE COST									
PROJECTFort Riley Feasibility Study for HVAC Upgrade									
ENGINEERE M C Engineers, Inc. Denver, CO									
SHEET1 OF1									
DATE PREPARED4-May-95									
ESTIMATORC. Wohliert									
CHECKED BYA. Niemeyer									
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 7243							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4									
5	AHUH1300	NEW SYSTEMS INSTALLATION 1,300 CFM AHU	EA.	5.0	\$2,296.53	\$11,483	Q-5	13.9965	\$1,357
6	12X6SA	12X6 SA GRILLES	EA.	20.0	\$9.84	\$197	1-SHEE	0.348	\$145
7	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	470.0	\$0.47	\$219	Q-10	0.098	\$895
8	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT. 3 WIRE	EA.	5.0	\$24.23	\$121	1-ELEC	0.8	\$84
9	WIRE#12	COPPER WIRING #12	C.L.F.	2.5	\$7.41	\$19	1-ELEC	0.727	\$38
10	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	420.0	\$2.95	\$1,237	Q-1	0.2	\$1,629
11		VALVES AND FITTINGS ADD 15%				\$186			\$244
12	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	210.0	\$1.40	\$293	Q-14	0.08	\$309
13	CNTVLV1.25	CONTROL VALVE 2-1/2"	EA.	5.0	\$935.09	\$4,675	1-PLUM	3.556	\$383
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26		WAC REMOVAL	TON	1.9			Q-5	17.778	\$655
27		DUCT & EXHAUST FANS	TON	0.5			Q-5	17.778	\$172
28		ASBESTOS REMOVAL	GLV. BAG	6.0	\$170.00	\$1,020			\$1,020
29									
30									
31		SUBTOTAL				\$19,449			\$5,911
32	OH	OVERHEAD			17%	\$3,267			\$993
33	PRO	PROFIT			10%	\$2,272			\$690
34	CONT	CONTINGENCY			20%	\$4,998			\$1,519
35	TOTAL COST					\$29,985			\$9,114
									\$25,360
									\$4,260
									\$2,962
									\$6,517
									\$39,099

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET		1	OF	1	
ENGINEER		E M C Engineers, Inc. Denver, CO		DATE PREPARED		4-May-95			
				ESTIMATOR		C. Wohler			
				CHECKED BY		A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST		TOTAL	
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	TOTAL
1		BUILDING 7243							
2		NON-RECURRING							
3									
4									
5	WAC1.5	EXISTING SYSTEM REPLACEMENT WINDOW AIR CONDITIONER, 1.5 TON	EA.	15.0	\$750.98	L-2	2.667	\$645	\$11,910
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21		EXISTING SYSTEMS DEMOLITION							
22		WAC REMOVAL	TON	1.9		Q-5	17.778	\$655	\$655
23		DUCT & EXHAUST FANS	TON	0.5		Q-5	17.778	\$172	\$172
24									
25									
26									
27									
28									
29									
30									
31									
32									
33	OH	SUBTOTAL			\$11,265			\$1,473	\$12,737
34	PRO	OVERHEAD			17%			\$247	\$2,140
35	CONT	PROFIT			10%			\$172	\$1,488
		CONTINGENCY			20%			\$378	\$3,273
		TOTAL COST			\$17,367			\$2,271	\$19,638

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7243							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-FC	MAINT. ON FCs - INSPEC. / YR	EA.	15.0	\$0.00	\$0	Q-6	4	\$1,206
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$1,206
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17		MAINT. ON AHU - INSPEC. / YR <= 5000 CFM		5.0			Q-6	19	\$1,910
18	MNT-AHU1								
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$1,910
30									
31									
32									
33									
34		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	(\$704)
35									(\$704)

DEMAND LIMITING ANALYSIS BUILDING 7243

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$ 20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	12.94	15.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.04
CAPACITY (KW)	32459	34437	26136	20754	26400	22752	27108	25812	23310	21834	21996	30083
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32721	34750	26373	20775	26453	22820	27244	25916	23404	21878	22084	30448
80% SUMMER PEAK (KVA)	27800	27800	27800	27800	27800	27800	27800	27800	27800	27800	27800	27800
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32721	34750	27800	27800	27800	27800	27800	27800	27800	27800	27800	30448
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,089.33	\$138,305.48	\$110,158.39	\$110,158.39	\$110,158.39	\$110,158.39	\$110,158.39	\$110,158.39	\$110,158.39	\$110,158.39	\$110,158.39	\$120,885.76
SUB DISCOUNT \$ 20	(\$6,544.16)	(\$6,949.90)	(\$5,559.92)	(\$5,559.92)	(\$5,559.92)	(\$5,559.92)	(\$5,559.92)	(\$5,559.92)	(\$5,559.92)	(\$5,559.92)	(\$5,559.92)	(\$6,089.67)
CAPACITY CHARGE	\$126,135.17	\$133,945.58	\$107,188.47	\$107,188.47	\$107,188.47	\$107,188.47	\$107,188.47	\$107,188.47	\$107,188.47	\$107,188.47	\$107,188.47	\$117,386.10
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,198.25	\$68,178.52	\$54,542.82	\$54,542.82	\$54,542.82	\$54,542.82	\$54,542.82	\$54,542.82	\$54,542.82	\$54,542.82	\$54,542.82	\$59,739.64
100*KVA @ \$.03404	\$111,381.68	\$118,287.31	\$94,629.84	\$94,629.84	\$94,629.84	\$94,629.84	\$94,629.84	\$94,629.84	\$94,629.84	\$94,629.84	\$94,629.84	\$103,646.14
250*KVA @ \$.03084	\$252,277.54	\$267,918.66	\$210,022.24	\$184,116.64	\$214,334.93	\$214,334.93	\$214,334.93	\$214,334.93	\$214,334.93	\$212,797.84	\$171,163.84	\$234,756.67
EXCESS @ \$.02864	\$109,739.06	\$65,877.70	\$0.00	\$0.00	\$1,150.16	\$51,842.96	\$42,391.76	\$32,940.56	\$38,954.96	\$0.00	\$0.00	\$28,372.66
ENERGY CHARGE	\$537,596.53	\$520,262.19	\$359,194.91	\$333,289.31	\$364,657.75	\$415,350.55	\$405,899.35	\$396,448.15	\$402,462.55	\$361,970.51	\$320,336.51	\$426,515.11
TOTAL CHARGE LESS ECA	\$663,731.70	\$654,207.78	\$466,383.37	\$440,477.77	\$471,846.22	\$522,539.02	\$513,087.82	\$503,636.62	\$509,651.02	\$469,158.97	\$427,524.97	\$543,901.20
SUMMARY												
MONTHLY DIFFERENCE	\$71.37	\$84.14	\$56.48	\$56.48	\$67.31	\$67.31	\$67.31	\$67.31	\$67.31	\$56.48	\$56.48	\$72.22
ANNUAL DIFFERENCE.....												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 27 RECTANGULAR 27 OTHER 0
 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
1ST COMPANY		1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
2-COMPANY		1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
5TH COMPANY		1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
3-COMPANY		1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
4-COMPANY		1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
5TH COMPANY		0.000	0.00	0.096	420.00	0.096	420.00	SOUTH-WEST
5EQUIPMAN		0.000	0.00	0.096	767.00	0.096	767.00	SOUTH-WEST
1EQUIPMAN		0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
2-EQUIPMAN		0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
3-EQUIPMAN		0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
5EQUIPMAN		0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
4-EQUIPMAN		0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
5TH COMPANY		0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
5-VALT		0.000	0.00	0.020	340.00	0.020	340.00	ROOF
2-COMPANY		0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
2-VALT		0.000	0.00	0.020	340.00	0.020	340.00	ROOF
5EQUIPMAN		0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
1ST COMPANY		0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
3-COMPANY		0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
3-VALT		0.000	0.00	0.020	340.00	0.020	340.00	ROOF
2-EQUIPMAN		0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
3-EQUIPMAN		0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF

D2-7

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

1EQUIPMAN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
4-COMPANY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
4-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
1ARMS-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
4-EQUIPMAN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
1ST COMPANY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
1ARMS-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
1EQUIPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
2-COMPANY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
2-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
2-EQUIPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
5TH COMPANY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
5-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
5EQUIPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
3-COMPANY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND

3-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
3-EQUIPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
4-COMENY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
4-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
4-EQUIPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
SOUTH-EAST	1.021	0.096	0.318	720.00	2280.00	3000.00
SOUTH-WEST	0.000	0.096	0.096	0.00	1187.00	1187.00
NORTH-WEST	0.000	0.096	0.096	0.00	3250.00	3250.00
ROOF	0.000	0.088	0.088	0.00	23120.00	23120.00
ALL WALLS	1.021	0.096	0.186	720.00	6717.00	7437.00
WALLS+ROOFS	1.021	0.090	0.112	720.00	29837.00	30557.00
UNDERGRND	0.000	0.020	0.020	0.00	23120.00	23120.00
BUILDING	1.021	0.059	0.072	720.00	52957.00	53677.00

EMC ENGINEERS INC. EDDE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 20818 SQFT 1934 SQMT
VOLUME 263970 CUFT 7476 CUMT

COOLING LOAD HEATING LOAD
AUG 11 4PM SEP 18 2AM
100F 38C 50F 10C
71F 22C 48F 9C

TIME
DRY-BULB TEMP
WET-BULB TEMP

SENSIBLE (KBTU/H) (KW) LATENT (KBTU/H) (KW)
(KBTU/H) (KW)

WALLS 17.321 5.073 0.000 0.000 -14.824 -4.342
ROOFS 76.283 22.341 0.000 0.000 -46.805 -13.708
GLASS CONDUCTION 14.119 4.135 0.000 0.000 -19.288 -5.649
GLASS SOLAR 53.275 15.603 0.000 0.000 3.342 0.979
DOOR 0.000 0.000 0.000 0.000 0.000 0.000
INTERNAL SURFACES -5.695 -1.668 0.000 0.000 -5.695 -1.668
UNDERGROUND SURFACES -2.027 -0.594 0.000 0.000 -1.872 -0.548
OCCUPANTS TO SPACE 41.902 12.272 65.945 19.314 0.114 0.034
LIGHT TO SPACE 102.646 30.062 0.000 0.000 0.431 0.126
EQUIPMENT TO SPACE 13.487 3.950 0.000 0.000 0.037 0.011
PROCESS TO SPACE 0.000 0.000 0.000 0.000 0.000 0.000
INFILTRATION 35.761 10.473 4.909 1.438 -58.337 -17.086

TOTAL 347.073 101.649 70.854 20.751 -142.897 -41.851
TOTAL LOAD 417.927 KBTU/H 122.400 KW -142.897 KBTU/H -41.851 KW
TOTAL LOAD / AREA 20.08BTU/H.SQFT 63.288 W /SQMT 6.864BTU/H.SQFT 21.640 W /SQMT

* * NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* * * * * LOADS *
* * 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* * IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW AC1 TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	ELEC- TRICAL ENERGY (KWH)	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	4.12308	31	12	84.F	74.F	40.296						
JUN	10.72405	24	13	86.F	76.F	42.841						
JUL	12.80529	1	16	86.F	80.F	47.704						
AUG	14.36382	24	16	96.F	77.F	45.394						
SEP	8.45416	6	16	93.F	76.F	45.872						
OCT	0.06436	1	16	83.F	67.F	17.727						
TOTAL	50.535				-0.007							
MAX												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW AC1 TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING LOAD	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING LOAD	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	ELEC- TRICAL ENERGY (KWH)	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	199	4	0	0	205	24	0	0	0.000	11.622	0.000	11.622
JUN	430	0	0	0	290	0	0	0	0.000	12.182	0.000	12.182
JUL	478	0	0	0	266	0	0	0	0.000	12.844	0.000	12.844
AUG	522	0	0	0	222	0	0	0	0.000	13.507	0.000	13.507
SEP	350	0	0	0	370	0	0	0	0.000	13.263	0.000	13.263
OCT	5	0	0	0	19	0	0	0	0.000	3.998	0.000	3.998
ANNUAL 1984		4	0	0	1372	24	0	0				

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW AC2 WINDOW AC2 TOPEKA, KS

-- C O O L I N G --										-- H E A T I N G --										-- E L E C --									
COOLING					MAXIMUM					HEATING					MAXIMUM					ELEC- TRICAL					ELEC- TRICAL				
ENERGY (MBTU)					LOAD (KBTU/HR)					ENERGY (MBTU)					LOAD (KBTU/HR)					ENERGY (KWH)					ENERGY (KWH)				
OF MAX					TIME					OF MAX					TIME					OF MAX					OF MAX				
DY HR					DRY- WET- BULB					DY HR					DRY- WET- BULB					DY HR					DY HR				
TEMP					TEMP					TEMP					TEMP					TEMP					TEMP				
MONTH					MONTH					MONTH					MONTH					MONTH					MONTH				
MAY					4.15058					31 12 84.F 74.F					40.265					-0.007					1267.				
JUN					10.92451					20 13 86.F 76.F					42.871					0.000					3036.				
JUL					13.10437					1 16 86.F 80.F					47.838					0.000					3396.				
AUG					14.64564					24 16 96.F 77.F					45.646					0.000					3909.				
SEP					8.55941					6 16 93.F 76.F					45.853					0.000					2525.				
OCT					0.06313					1 16 83.F 67.F					17.480					0.000					16.				
TOTAL					51.448					-0.007					47.838					14150.					13.548				
MAX																													

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW AC2 WINDOW AC2 TOPEKA, KS

-- N U M B E R O F H O U R S --										--COINCIDENT LOADS--									
HOURS					HOURS					HOURS					HOURS				
COOLING					COOLING					COOLING					COOLING				
LOAD					LOAD					LOAD					LOAD				
MONTH					MONTH					MONTH					MONTH				
MAY					200					4					204				
JUN					436					0					284				
JUL					485					0					259				
AUG					529					0					215				
SEP					355					0					365				
OCT					5					0					19				
ANNUAL 2010					4					0					1346				
															24				
															3360				
															2083				
															2083				
															0				
															73				

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V TOPEKA, KS

-- C O O L I N G --										H E A T I N G --										-- E L E C --									
COOLING					MAXIMUM					HEATING					MAXIMUM					ELEC-					ELEC				
ENERGY (MBTU)					COOLING LOAD (KBTU/HR)					ENERGY (MBTU)					HEATING LOAD (KBTU/HR)					TRICAL ENERGY (KWH)					LOAD (KW)				
MONTH	COOLING	TIME OF MAX	DRY- BULB	WET- BULB	TEMP	TEMP	TEMP	TEMP	TEMP	TIME OF MAX	DRY- BULB	WET- BULB	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
MAY	0.00000	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	15	23	66.F	63.F	-1.754	0.000	0.000	0.000	0.000	5930.	10961.	28.552	28.552	28.552	28.552	28.552	28.552	28.552	28.552
JUN	0.00000	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10802.	11378.	28.552	28.552	28.552	28.552	28.552	28.552	28.552	28.552
JUL	0.00000	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10770.	225.	9.360	9.360	9.360	9.360	9.360	9.360	9.360	9.360
AUG	0.00000	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50065.	-1.754	28.552	28.552	28.552	28.552	28.552	28.552	28.552	28.552
SEP	0.00000	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50065.	-1.754	28.552	28.552	28.552	28.552	28.552	28.552	28.552	28.552
OCT	0.00000	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	50065.	-1.754	28.552	28.552	28.552	28.552	28.552	28.552	28.552	28.552
TOTAL	0.000									-0.015																			
MAX																													

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V TOPEKA, KS

-- N U M B E R O F H O U R S --										--COINCIDENT LOADS--									
HOURS					HOURS					HOURS					HOURS				
COOLING					HEATING					HEATING					HEATING				
LOAD					LOAD					LOAD					LOAD				
MONTH	COOLING	HEATING	COOL-HEAT	COINCIDENT	COOLING	HEATING	COOL-HEAT	COINCIDENT	COINCIDENT	COOLING	HEATING	COOL-HEAT	COINCIDENT	COINCIDENT	COOLING	HEATING	COOL-HEAT	COINCIDENT	COINCIDENT
LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD
MAY	0	12	0	0	396	24	0	408	0	0	0	0	0	0	396	0.000	0.000	0.000	0.000
JUN	0	0	0	0	720	0	0	720	0	0	0	0	0	0	720	0.000	0.000	0.000	0.000
JUL	0	0	0	0	744	0	0	744	0	0	0	0	0	0	744	0.000	0.000	0.000	0.000
AUG	0	0	0	0	744	0	0	744	0	0	0	0	0	0	744	0.000	0.000	0.000	0.000
SEP	0	0	0	0	720	0	0	720	0	0	0	0	0	0	720	0.000	0.000	0.000	0.000
OCT	0	0	0	0	24	0	0	24	0	0	0	0	0	0	24	0.000	0.000	0.000	0.000
ANNUAL	0	12	0	0	3348	24	0	3360	0	0	0	0	0	0	3348	0.000	0.000	0.000	0.000

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW AC3 TOPEKA, KS

MONTH	C O O L I N G						H E A T I N G						E L E C					
	COOLING			MAXIMUM			HEATING			MAXIMUM			ELEC			MAXIMUM		
	ENERGY (MBTU)			COOLING LOAD (KBTU/HR)			ENERGY (MBTU)			HEATING LOAD (KBTU/HR)			TRICAL ENERGY (KWH)			ELEC LOAD (KW)		
	TIME OF MAX DY HR	WET-BULB TEMP	DRY-BULB TEMP	TIME OF MAX DY HR	WET-BULB TEMP	DRY-BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	WET-BULB TEMP	DRY-BULB TEMP	HEATING LOAD (KBTU/HR)	TRICAL ENERGY (KWH)	ELEC LOAD (KW)					
MAY	4.06792	31	12	84.F	74.F	40.320	-0.012	15	6	60.F	60.F	-2.986	1251.	11.879				
JUN	10.89381	20	13	86.F	76.F	42.887	0.000				0.000	0.000	3032.	12.426				
JUL	13.14686	1	16	86.F	80.F	47.821	0.000				0.000	0.000	3405.	13.032				
AUG	14.68221	24	16	96.F	77.F	45.736	0.000				0.000	0.000	3917.	13.563				
SEP	8.45038	6	16	93.F	76.F	46.004	0.000				0.000	0.000	2504.	13.284				
OCT	0.05428	1	16	83.F	67.F	16.653	0.000				0.000	0.000	13.	3.817				
TOTAL	51.295						-0.012					-2.986	14122.	13.563				
MAX						47.821												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW AC3 TOPEKA, KS

N U M B E R O F H O U R S										C O I N C I D E N T L O A D S									
COOLING					HEATING					COOLING					HEATING				
LOAD					LOAD					LOAD					LOAD				
HOURS					HOURS					HOURS					HOURS				
COOL-HEAT					COOL-HEAT					COOL-HEAT					COOL-HEAT				
LOAD					LOAD					LOAD					LOAD				
MONTH					MONTH					MONTH					MONTH				
MAY	195	6	0	207	24	408	195	195	0	0	0.000	11.626			0	0	0.000	11.626	
JUN	435	0	0	285	0	720	435	435	0	0	0.000	12.185			0	0	0.000	12.185	
JUL	486	0	0	258	0	744	486	486	0	0	0.000	12.861			0	0	0.000	12.861	
AUG	529	0	0	215	0	744	529	529	0	0	0.000	13.563			0	0	0.000	13.563	
SEP	348	0	0	372	0	720	419	419	0	0	0.000	13.284			0	0	0.000	13.284	
OCT	4	0	0	20	0	24	15	15	0	0	0.000	3.817			0	0	0.000	3.817	
ANNUAL 1997		6	0	1357	24	3360	2079	2079	0	82									

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW AC4 TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
MAY	4.12948	31 12	84.F	74.F	-0.007	15 6	60.F	60.F	-2.410	1263.	11.865	
JUN	10.82641	20 13	86.F	76.F	0.000				0.000	3018.	12.448	
JUL	12.90734	1 16	86.F	80.F	0.000				0.000	3360.	13.022	
AUG	14.49736	24 16	96.F	77.F	0.000				0.000	3883.	13.534	
SEP	8.51880	6 16	93.F	76.F	0.000				0.000	2518.	13.269	
OCT	0.06434	1 16	83.F	67.F	0.000				0.000	16.	4.000	
TOTAL MAX	50.944				-0.007				-2.410	14058.	13.534	

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW AC4 TOPEKA, KS

MONTH	HOURS				N U M B E R O F				H O U R S				C O I N C I D E N T L O A D S			
	COOLING LOAD	HEATING LOAD	COOL-HEAT LOAD	COINCIDENT LOAD	FLOATING	HEATING AVAIL.	COOLING AVAIL.	FANS ON CYCLE	HOURS FANS ON	HOURS NIGHT	FLOATING WHEN	HEATING LOAD AT	ELECTRIC LOAD AT	COOLING PEAK	COOLING PEAK	ELECTRIC PEAK
MAY	199	4	0	0	205	24	408	199	199	0	0	0.000	11.620	0.000	0.000	11.620
JUN	434	0	0	0	286	0	720	434	434	0	0	0.000	12.177	0.000	0.000	12.177
JUL	480	0	0	0	264	0	744	480	480	0	0	0.000	12.851	0.000	0.000	12.851
AUG	526	0	0	0	218	0	744	526	526	0	0	0.000	13.534	0.000	0.000	13.534
SEP	353	0	0	0	367	0	720	416	416	0	63	0.000	13.269	0.000	0.000	13.269
OCT	5	0	0	0	19	0	24	15	15	0	10	0.000	4.000	0.000	0.000	4.000
ANNUAL 1997		4	0	0	1359	24	3360	2070	2070	0	73					

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW AC5 TOPEKA, KS

MONTH	-- C O O L I N G --					-- H E A T I N G --					-- E L E C --				
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
MAY	4.12934	31 12	84.F	74.F	40.283	-0.007	15 6	60.F	60.F	-2.414	1263.	11.865	1263.	11.865	
JUN	10.82234	20 13	86.F	76.F	42.832	0.000				0.000	3017.	12.448	3017.	12.448	
JUL	12.90737	1 16	86.F	80.F	47.752	0.000				0.000	3360.	13.022	3360.	13.022	
AUG	14.49717	24 16	96.F	77.F	45.558	0.000				0.000	3883.	13.534	3883.	13.534	
SEP	8.51539	6 16	93.F	76.F	45.912	0.000				0.000	2516.	13.269	2516.	13.269	
OCT	0.06433	1 16	83.F	67.F	17.742	0.000				0.000	16.	4.000	16.	4.000	
TOTAL	50.936					-0.007					14055.		14055.		
MAX					47.752					-2.414		13.534		13.534	

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW AC5 TOPEKA, KS

-- N U M B E R O F H O U R S --										--COINCIDENT LOADS--									
MONTH	HOURS COINCIDENT COOL-HEAT LOAD		HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON VENTING	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)		ELECTRIC LOAD AT COOLING PEAK (KW)									
	HOURS COINCIDENT COOL-HEAT LOAD	HOURS HEATING AVAIL.						HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON VENTING	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)						
MAY	199	4	0	205	24	408	199	199	0	0	0.000	11.620							
JUN	433	0	0	287	0	720	433	433	0	0	0.000	12.177							
JUL	480	0	0	264	0	744	480	480	0	0	0.000	12.851							
AUG	526	0	0	218	0	744	526	526	0	0	0.000	13.534							
SEP	352	0	0	368	0	720	415	415	0	63	0.000	13.269							
OCT	5	0	0	19	0	24	15	15	0	10	0.000	4.000							
ANNUAL 1995	1995	4	0	1361	24	3360	2068	2068	0	73									

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY 41.786 300.097 31/16	NATURAL-GAS 0.077 17.606 15/ 5
MAY	TOTAL(MBTU) PEAK(KBTU) DY/HR	88.991 309.888 28/16	0.000 0.000 30/ 1
JUN	TOTAL(MBTU) PEAK(KBTU) DY/HR	94.464 319.705 13/13	0.000 0.000 31/ 1
JUL	TOTAL(MBTU) PEAK(KBTU) DY/HR	105.260 328.598 24/16	0.000 0.000 31/ 1
AUG	TOTAL(MBTU) PEAK(KBTU) DY/HR	79.684 324.019 6/16	0.000 0.000 30/ 1
SEP	TOTAL(MBTU) PEAK(KBTU) DY/HR	1.027 99.463 1/16	0.000 0.000 1/ 1
OCT			
	ONE YEAR USE/PEAK	411.213 328.598	0.077 17.606

D2-17

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	IN SITE MBTU -	ELECTRICITY	NATURAL-GAS
CATEGORY OF USE			
SPACE HEAT	0.00	0.08	
SPACE COOL	175.40	0.00	
HVAC AUX	108.52	0.00	
DOM HOT WTR	0.00	0.00	
AUX SOLAR	0.00	0.00	
LIGHTS	113.06	0.00	
VERT TRANS	0.00	0.00	
MISC EQUIP	14.24	0.00	
TOTAL	411.21	0.08	

TOTAL SITE ENERGY 411.29 MBTU 17.5 KBTU/SQFT-YR GROSS-AREA 19.8 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1234.95 MBTU 52.6 KBTU/SQFT-YR GROSS-AREA 59.3 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 24.3
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#1 TOPEKA, KS

MONTH	C O O L I N G					H E A T I N G					E L E C				
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	ELEC LOAD (KW)	MAXIMUM		
MAY	3.57519	31 12	84.F	74.F	46.374	-0.001	15 23	66.F	63.F	-0.384	436.	3.913	3.913		
JUN	10.25514	20 13	86.F	76.F	47.291	0.000				0.000	873.	3.913	3.913		
JUL	12.62197	1 16	86.F	80.F	53.889	0.000				0.000	798.	3.913	3.913		
AUG	14.04644	23 15	95.F	77.F	50.164	0.000				0.000	916.	3.913	3.913		
SEP	7.75637	6 16	93.F	76.F	50.324	0.000				0.000	833.	3.913	3.913		
OCT	0.04601	1 18	83.F	58.F	14.649	0.000				0.000	1.	0.065	0.065		
TOTAL	48.301					-0.001					3857.		3.913		
MAX					53.889					-0.384					

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#1 TOPEKA, KS

COOLING LOAD	HOURS OF MONTH						HOURS						--COINCIDENT LOADS--					
	HOURS HEATING	HOURS COOL-HEAT	HOURS FLOATING	HOURS HEATING	HOURS COOLING	HOURS AVAIL.	HOURS FANS ON	HOURS CYCLE ON	HOURS NIGHT	FLOATING WHEN	HEATING LOAD AT PEAK	ELECTRIC LOAD AT COOLING PEAK						
MONTH	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	LOAD	(KBTU/HR)	(KW)						
MAY	180	5	0	223	24	384	191	191	0	6	0.000	3.913						
JUN	402	0	0	318	0	720	402	402	0	0	0.000	3.913						
JUL	441	0	0	303	0	744	441	441	0	0	0.000	3.913						
AUG	482	0	0	262	0	744	482	482	0	0	0.000	3.913						
SEP	325	0	0	395	0	655	390	390	0	65	0.000	3.913						
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.065						
ANNUAL	1834	5	0	1521	24	3260	1921	1921	0	82								

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#2 TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
MAY	3.59990	31	12	84.F	74.F	15	23	66.F	63.F	436.	3.913	
JUN	10.45370	20	13	86.F	76.F	0.000			0.000	873.	3.913	
JUL	13.00339	1	16	86.F	80.F	0.000			0.000	799.	3.913	
AUG	14.39960	24	16	96.F	77.F	0.000			0.000	917.	3.913	
SEP	7.84052	6	16	93.F	76.F	0.000			0.000	833.	3.913	
OCT	0.04523	1	18	83.F	68.F	0.000			0.000	1.	0.065	
TOTAL	49.342				-0.001				-0.371	3858.	3.913	
MAX												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#2 TOPEKA, KS

MONTH	N U M B E R O F H O U R S												C O I N C I D E N T L O A D S			
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE	HOURS FANS ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)				
MAY	181	5	0	222	24	384	192	192	0	6	0.000	3.913				
JUN	404	0	0	316	0	720	404	404	0	0	0.000	3.913				
JUL	451	0	0	293	0	744	451	451	0	0	0.000	3.913				
AUG	489	0	0	255	0	744	489	489	0	0	0.000	3.913				
SEP	325	0	0	395	0	656	389	389	0	64	0.000	3.913				
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.065				
ANNUAL	1854	5	0	1501	24	3261	1940	1940	0	81						

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1												
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG												
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V TOPEKA, KS												
----- C O O L I N G ----- H E A T I N G ----- E L E C -----												
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-	
											TRICAL ENERGY (KWH)	
											MAXIMUM ELEC LOAD (KW)	
MAY	0.00000				0.000	-0.015	15 23	66.F	63.F	-1.761	5930.	28.552
JUN	0.00000				0.000	0.000				0.000	10961.	28.552
JUL	0.00000				0.000	0.000				0.000	10802.	28.552
AUG	0.00000				0.000	0.000				0.000	11378.	28.552
SEP	0.00000				0.000	0.000				0.000	10770.	28.552
OCT	0.00000				0.000	0.000				0.000	225.	9.360
TOTAL	0.000				0.000	-0.015				-1.761	50065.	28.552
MAX												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1									
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG									
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V TOPEKA, KS									
----- N U M B E R O F H O U R S -----									
HOURS									
HOURS COINCIDENT		HOURS HEATING		HOURS COOLING		HOURS FANS ON CYCLE		HOURS FLOATING	
COOLING		LOAD		AVAIL.		FANS ON		WHEN	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON		FANS ON	
LOAD		LOAD		AVAIL.		FANS ON			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#3 TOPEKA, KS

MONTH	-- C O O L I N G --						-- H E A T I N G --						-- E L E C --					
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)		ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)				
MAY	3.56298	31 12	84.F	74.F	46.437		-0.001	15 23	66.F	63.F	-0.396		435.	3.913				
JUN	10.35086	20 13	86.F	76.F	47.456		0.000				0.000		872.	3.913				
JUL	13.05706	1 16	86.F	80.F	54.208		0.000				0.000		799.	3.913				
AUG	14.42620	24 16	96.F	77.F	50.392		0.000				0.000		917.	3.913				
SEP	7.75137	6 16	93.F	76.F	50.534		0.000				0.000		834.	3.913				
OCT	0.03686	1 17	85.F	68.F	14.932		0.000				0.000		1.	0.065				
TOTAL	49.185						-0.001						3858.					
MAX					54.208						-0.396				3.913			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#3 TOPEKA, KS

-- N U M B E R O F H O U R S --										--COINCIDENT LOADS--									
COOLING		HEATING		COOL-HEAT		COINCIDENT		HOURS		HEATING		LOAD AT		COOLING		PEAK		COOLING	
LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD	
(KBTU/HR)		(KBTU/HR)		(KBTU/HR)		(KBTU/HR)		(KBTU/HR)		(KBTU/HR)		(KBTU/HR)		(KBTU/HR)		(KBTU/HR)		(KBTU/HR)	
MAY	177	4	0	0	227	24	384	187	187	0	6	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
JUN	400	0	0	320	0	0	720	400	400	0	0	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
JUL	451	0	0	293	0	0	744	451	451	0	0	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
AUG	487	0	0	257	0	0	744	487	487	0	0	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
SEP	320	0	0	400	0	0	644	396	396	0	76	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
OCT	3	0	0	21	0	0	13	14	14	0	11	0.000	0.065	0.000	0.065	0.000	0.065	0.000	0.065
ANNUAL	1838	4	0	1518	24	3249	1935	1935	1935	0	93								

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#4 TOPEKA, KS

MONTH	-- C O O L I N G --					-- H E A T I N G --					-- E L E C --				
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)			
MAY	3.58158	31 12	84.F	74.F	46.364	-0.001	15 23	66.F	63.F	-0.383	436.	3.913			
JUN	10.32119	20 13	86.F	76.F	47.304	0.000				0.000	873.	3.913			
JUL	12.76184	1 16	86.F	80.F	53.980	0.000				0.000	798.	3.913			
AUG	14.18440	24 16	96.F	77.F	50.089	0.000				0.000	916.	3.913			
SEP	7.79198	6 16	93.F	76.F	50.334	0.000				0.000	833.	3.913			
OCT	0.04606	1 18	83.F	68.F	14.650	0.000				0.000	1.	0.065			
TOTAL	48.687					-0.001					3857.				
MAX					53.980					-0.383		3.913			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#4 TOPEKA, KS

-- N U M B E R O F H O U R S --										-- C O I N C I D E N T L O A D S --									
COOLING					HEATING					ELECTRIC					COOLING				
MONTH	LOAD	HEATING	COOL-HEAT	LOAD	LOAD	HEATING	AVAIL.	COOLING	AVAIL.	HEATING	LOAD	COOLING	AVAIL.	PEAK	LOAD	HEATING	AVAIL.	COOLING	AVAIL.
MAY	180	5	0	0	223	24	384	191	191	0	6	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
JUN	403	0	0	0	317	0	720	403	403	0	0	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
JUL	445	0	0	0	299	0	744	445	445	0	0	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
AUG	484	0	0	0	260	0	744	484	484	0	0	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
SEP	325	0	0	0	395	0	655	390	390	0	65	0.000	3.913	0.000	3.913	0.000	3.913	0.000	3.913
OCT	4	0	0	0	20	0	13	15	15	0	11	0.000	0.065	0.000	0.065	0.000	0.065	0.000	0.065
ANNUAL	1841	5	0	0	1514	24	3260	1928	1928	0	82								

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#5 TOPEKA, KS

C O O L I N G										H E A T I N G										E L E C									
COOLING					MAXIMUM					HEATING					MAXIMUM					ELEC-					TRICAL				
ENERGY (MBTU)					COOLING LOAD (KBTU/HR)					ENERGY (MBTU)					HEATING LOAD (KBTU/HR)					ENERGY (KWH)					ENERGY (KWH)				
MONTH	TIME OF MAX	DRY- BULB	WET- BULB	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TIME OF MAX	DRY- BULB	WET- BULB	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TIME OF MAX	DRY- BULB	WET- BULB	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
MAY	3.58066	31	12	84.F	74.F	46.364	47.306	53.981	50.088	15	23	66.F	63.F	-0.383	0.000	0.000	0.000	0.000	0.000	436.	873.	798.	916.	833.	1.	0.065	3.913	3.913	3.913
JUN	10.32143	20	13	86.F	76.F	47.306	53.981	50.088	50.334	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JUL	12.76211	1	16	86.F	80.F	53.981	50.088	50.334	14.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AUG	14.18472	24	16	96.F	77.F	50.088	50.334	14.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SEP	7.79025	6	16	93.F	76.F	50.334	14.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OCT	0.04586	1	18	83.F	68.F	14.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	48.685									-0.001					-0.383					3857.									
MAX																													

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#5 TOPEKA, KS

N U M B E R O F H O U R S										C O I N C I D E N T L O A D S									
COOLING					HEATING					ELECTRIC					LOAD AT				
LOAD					LOAD					LOAD					LOAD				
MONTH	HOURS	HEATING	COOL-HEAT	COINCIDENT	HOURS	HEATING	COOLING	AVAIL.	HOURS	HEATING	COOLING	AVAIL.	HOURS	HEATING	COOLING	AVAIL.	HOURS	HEATING	COOLING
MAY	180	5	0	0	223	24	384	191	191	0	0	0	6	0.000	0.000	0.000	3.913	3.913	3.913
JUN	403	0	0	0	317	0	720	403	403	0	0	0	0	0.000	0.000	0.000	3.913	3.913	3.913
JUL	445	0	0	0	299	0	744	445	445	0	0	0	0	0.000	0.000	0.000	3.913	3.913	3.913
AUG	484	0	0	0	260	0	744	484	484	0	0	0	0	0.000	0.000	0.000	3.913	3.913	3.913
SEP	325	0	0	0	395	0	555	390	390	0	0	0	65	0.000	0.000	0.000	3.913	3.913	3.913
OCT	4	0	0	0	20	0	13	15	15	0	0	0	11	0.000	0.000	0.000	0.065	0.065	0.065
ANNUAL 1841	5	0	0	0	1514	24	3260	1928	1928	0	0	0	82						

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY -	ELECTRICITY	NATURAL-GAS
	TOTAL (MBTU)	33.938	0.028
MAY	PEAK (KBTU)	225.272	4.620
	DY/HR	31/12	15/23
	TOTAL (MBTU)	69.547	0.000
JUN	PEAK (KBTU)	227.128	0.000
	DY/HR	24/13	30/ 1
	TOTAL (MBTU)	72.657	0.000
JUL	PEAK (KBTU)	237.577	0.000
	DY/HR	1/16	31/ 1
	TOTAL (MBTU)	77.991	0.000
AUG	PEAK (KBTU)	231.881	0.000
	DY/HR	24/16	31/ 1
	TOTAL (MBTU)	63.898	0.000
SEP	PEAK (KBTU)	230.847	0.000
	DY/HR	6/16	30/ 1
	TOTAL (MBTU)	0.954	0.000
OCT	PEAK (KBTU)	61.832	0.000
	DY/HR	1/18	1/ 1
	ONE YEAR	318.984	0.028
	USE/PEAK	237.577	4.620

D2-24

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	0.00	0.03
SPACE COOL	74.26	0.00
HVAC AUX	117.43	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	113.06	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	14.24	0.00
TOTAL	318.98	0.03

TOTAL SITE ENERGY 319.01 MBTU 13.6 KBTU/SQFT-YR GROSS-AREA 15.3 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 957.94 MBTU 40.8 KBTU/SQFT-YR GROSS-AREA 46.0 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 16.7
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 7602 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	363.90	316.01	47.89	24.93
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	70.99	64.07	6.91	3.60
Electric Demand July (KW)	72.60	66.89	5.71	2.97
Electric Demand August (KW)	73.42	65.42	8.00	4.17

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8021 (sq.ft.)	22517.5
ECO Model Bldg 7602 (sq.ft.)	11723.5
Square Footage Adjustment Factor	0.521

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohlert

1. INVESTMENT: BLDG 7602 - Replace Existing SZ Cooling AHUs w/ New SZ Cooling AHUs

A. CONSTRUCTION COST	=	\$21,599
B. SIOH COST	(5.5% of 1A) =	\$1,188
C. DESIGN COST	(6.0% of 1A) =	\$1,296
D. TOTAL COST	(1A + 1B + 1C) =	\$24,083
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$24,083

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	25	\$302	15.88	\$4,790
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	0	\$0	18.30	\$0
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$213	14.88	\$3,170
F. TOTAL		25	\$515		-----> \$7,960

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMENT	\$20,550	5	0.863	\$17,735
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$20,550			\$17,735

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$17,735

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$1,542

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 15.62

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$25,695

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 1.07

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST											
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade									
ENGINEER		E M C Engineers, Inc.									
		Denver, CO									
		SHEET		1		OF		1			
		DATE PREPARED		4-May-95							
		ESTIMATOR		C. Wohler							
		CHECKED BY		A. Niemeyer							

ENGINEER'S OPINION OF PROBABLE COST			SHEET	1	OF	1
PROJECT	Fort Riley Feasibility Study for HVAC Upgrade					
ENGINEER	E M C Engineers, Inc. Denver, CO					
			DATE PREPARED			
			4-May-95			
			ESTIMATOR			
			C. Wohliert			
			CHECKED BY			
			A. Niemeyer			

D2-28

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED		4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR		C. Wohler	
										CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL			
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total				
1		BUILDING 7602											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0			\$0	
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0			\$0	
30													
31													
32													
33													
34													
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0			\$0	

DEMAND LIMITING ANALYSIS BUILDING 7602

SUMMER PEAK (KW) = 27812	JUL BILL 7/1-8/2 ACTUAL	AUG BILL 8/2-9/1 ACTUAL	SEP BILL 9/3-10/1 ACTUAL	OCT BILL 10/1-11/1 ACTUAL	NOV BILL 11/1-12/1 ACTUAL	DEC BILL 12/1-1/3 ACTUAL	JAN BILL 1/4-2/1 ACTUAL	FEB BILL 2/1-3/1 ACTUAL	MAR BILL 3/3-4/1 ACTUAL	APR BILL 4/1-5/3 ACTUAL	MAY BILL 5/3-6/1 ACTUAL	JUN BILL 6/1-7/1 ACTUAL
	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL	1993 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,165.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	2.97	4.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60
CAPACITY (KW)	32469	34448	26136	20754	26400	22752	27108	25812	23310	21834	21996	30092
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32731	34761	26373	20775	26453	22820	27244	25916	23404	21878	22084	30458
80% SUMMER PEAK (KVA)	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32731	34761	27809	27809	27809	27809	27809	27809	27809	27809	27809	30458
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,130.04	\$138,350.76	\$110,194.61	\$110,194.61	\$110,194.61	\$110,194.61	\$110,194.61	\$110,194.61	\$110,194.61	\$110,194.61	\$110,194.61	\$120,924.48
SUB DISCOUNT \$.20	(\$6,546.18)	(\$6,952.14)	(\$5,561.71)	(\$5,561.71)	(\$5,561.71)	(\$5,561.71)	(\$5,561.71)	(\$5,561.71)	(\$5,561.71)	(\$5,561.71)	(\$5,561.71)	(\$6,091.58)
CAPACITY CHARGE	\$126,173.87	\$133,988.62	\$107,222.90	\$107,222.90	\$107,222.90	\$107,222.90	\$107,222.90	\$107,222.90	\$107,222.90	\$107,222.90	\$107,222.90	\$117,422.90
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,217.98	\$68,200.46	\$54,560.36	\$54,560.36	\$54,560.36	\$54,560.36	\$54,560.36	\$54,560.36	\$54,560.36	\$54,560.36	\$54,560.36	\$59,758.39
100*KVA @ \$.03404	\$111,415.90	\$118,325.36	\$94,660.29	\$94,660.29	\$94,660.29	\$94,660.29	\$94,660.29	\$94,660.29	\$94,660.29	\$94,660.29	\$94,660.29	\$103,678.67
250*KVA @ \$.03084	\$252,355.05	\$268,004.85	\$209,980.87	\$184,075.27	\$214,403.88	\$214,403.88	\$214,403.88	\$214,403.88	\$214,403.88	\$212,736.47	\$171,122.47	\$234,830.37
EXCESS @ \$.02864	\$109,623.89	\$65,749.64	\$0.00	\$0.00	\$1,047.71	\$51,740.51	\$42,289.31	\$32,838.11	\$38,852.51	\$0.00	\$0.00	\$28,263.15
ENERGY CHARGE	\$537,612.82	\$520,280.30	\$359,201.52	\$333,295.92	\$364,672.24	\$415,365.04	\$405,913.84	\$396,462.64	\$402,477.04	\$361,977.12	\$320,343.12	\$426,530.59
TOTAL CHARGE LESS ECA	\$663,786.69	\$654,268.92	\$466,424.42	\$440,518.82	\$471,895.14	\$522,587.94	\$513,136.74	\$503,685.54	\$509,699.94	\$469,200.02	\$427,566.02	\$543,953.49
SUMMARY												
MONTHLY DIFFERENCE	\$16.39	\$22.99	\$15.43	\$15.43	\$18.39	\$18.39	\$18.39	\$18.39	\$18.39	\$15.43	\$15.43	\$19.93
ANNUAL DIFFERENCE		\$213.01										

3-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
3-EQUPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
4-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
4-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
4-EQUPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
SOUTH-EAST	1.021	0.096	0.318	720.00	2280.00	3000.00
SOUTH-WEST	0.000	0.096	0.096	0.00	1187.00	1187.00
NORTH-WEST	0.000	0.096	0.096	0.00	3250.00	3250.00
ROOF	0.000	0.088	0.088	0.00	23120.00	23120.00
ALL WALLS	1.021	0.096	0.186	720.00	6717.00	7437.00
WALLS+ROOFS	1.021	0.090	0.112	720.00	29837.00	30557.00
UNDERGRND	0.000	0.020	0.020	0.00	23120.00	23120.00
BUILDING	1.021	0.059	0.072	720.00	52957.00	53677.00

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- IS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 20818 SQFT 1934 SQMT
 VOLUME 263970 CUFT 7476 CUMT

HEATING LOAD
 OCT 1 7AM
 46F 8C
 44F 7C

COOLING LOAD
 AUG 11 4PM
 100F 38C
 71F 22C

TIME
 DRY-BULB TEMP
 WET-BULB TEMP

SENSIBLE
 (KBTU/H) (KW)

SENSIBLE
 (KBTU/H) (KW)

LATENT
 (KBTU/H) (KW)

WALLS	17.321	5.073	0.000	0.000	-18.715	-5.481
ROOFS	76.283	22.341	0.000	0.000	-60.379	-17.583
GLASS CONDUCTION	14.119	4.135	0.000	0.000	-22.364	-6.550
GLASS SOLAR	53.275	15.603	0.000	0.000	2.360	0.691
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	-5.695	-1.668	0.000	0.000	-5.695	-1.668
UNDERGROUND SURFACES	-2.027	-0.594	0.000	0.000	-3.116	-0.913
OCCUPANTS TO SPACE	41.902	12.272	65.945	19.314	1.613	0.472
LIGHT TO SPACE	102.646	30.062	0.000	0.000	6.074	1.779
EQUIPMENT TO SPACE	13.487	3.950	0.000	0.000	0.519	0.152
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	19.783	5.794	2.716	0.795	-17.645	-5.168
TOTAL	331.095	96.969	68.661	20.109	-117.348	-34.368
TOTAL LOAD	399.756	KBTU/H	117.078	KW	-117.348	KBTU/H
TOTAL LOAD / AREA	19.20BTU/H.SQFT		60.537	W /SQMT	5.637BTU/H.SQFT	17.770
						W /SQMT

 *
 * NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR
 *
 * --- LOADS
 *
 * 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION
 *
 * IN CONSIDERATION
 *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#1 TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
MAY	3.94869	31 16	88.F 75.F	41.034	-0.044	15 6	60.F 60.F		-7.467	450.	3.913	
JUN	12.77651	27 16	89.F 77.F	44.801	0.000				0.000	893.	3.913	
JUL	16.98791	1 16	86.F 80.F	51.049	0.000				0.000	818.	3.913	
AUG	17.38310	23 16	96.F 77.F	47.198	0.000				0.000	933.	3.913	
SEP	8.48008	7 15	92.F 76.F	45.509	0.000				0.000	855.	3.913	
OCT	0.04668	1 17	85.F 68.F	10.675	0.000				0.000	2.	0.065	
TOTAL	59.623			51.049	-0.044				-7.467	3931.	3.913	
MAX												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#1 TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING LOAD	HOURS HEATING LOAD	COOL-HEAT LOAD	COINCIDENT HOURS	COOLING AVAIL.	HEATING AVAIL.	FANS ON CYCLE ON	HOURS FANS ON	VENTING ON	COOLING PEAK (KBTU/HR)	HEATING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	271	16	0	0	272	408	0	0	0	0.000	0.000	3.913
JUN	636	0	0	0	638	720	0	0	0	0.000	0.000	3.913
JUL	728	0	0	0	729	744	0	0	0	0.000	0.000	3.913
AUG	727	0	0	0	727	744	0	0	0	0.000	0.000	3.913
SEP	450	0	0	0	457	720	0	0	0	0.000	0.000	3.913
OCT	6	0	0	0	7	24	0	0	0	0.000	0.000	0.065
ANNUAL	2818	16	0	0	2830	3360	0	0	0	526	526	

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#2 TOPEKA, KS

COOLING				HEATING				ELECTRIC			
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET-BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRIC ENERGY (KWH)	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRIC ENERGY (KWH)	MAXIMUM ELECTRIC LOAD (KW)
MAY	3.99891	31 16	88.F 75.F	-0.044	15 6	60.F 60.F	-7.402	450.	3.913	893.	3.913
JUN	12.97530	27 16	89.F 77.F	0.000			0.000	818.	3.913	933.	3.913
JUL	17.31594	1 16	86.F 80.F	0.000			0.000	855.	3.913	2.	0.065
AUG	17.67966	23 16	96.F 77.F	0.000			0.000				
SEP	8.59966	7 15	92.F 76.F	0.000			0.000				
OCT	0.04615	1 17	85.F 68.F	0.000			0.000				
TOTAL	60.616			-0.044			-7.402	3951.			3.913
MAX											

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#2 TOPEKA, KS

COOLING				HEATING				ELECTRIC			
MONTH	COOLING LOAD	HOURS HEATING	COINCIDENT LOAD	HOURS HEATING	COINCIDENT LOAD	HOURS HEATING	COINCIDENT LOAD	HOURS HEATING	COINCIDENT LOAD	HOURS HEATING	COINCIDENT LOAD
MAY	273	16	0	119	24	276	408	0	0	119	0.000
JUN	639	0	0	81	0	643	720	0	0	81	0.000
JUL	735	0	0	9	0	736	744	0	0	9	0.000
AUG	731	0	0	13	0	732	744	0	0	13	0.000
SEP	459	0	0	261	0	463	720	0	0	261	0.000
OCT	6	0	0	18	0	7	24	0	0	18	0.000
ANNUAL	2843	16	0	501	24	2857	3360	0	0	501	0.000

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V TOPEKA, KS

-- C O O L I N G --										-- H E A T I N G --										-- E L E C --									
COOLING		TIME		DRY- WET-		MAXIMUM		HEATING		TIME		DRY- WET-		MAXIMUM		ELEC- TRICAL		ELEC- TRICAL		ELEC- TRICAL		ELEC- TRICAL		ELEC- TRICAL		ELEC- TRICAL		ELEC- TRICAL	
ENERGY (MBTU)		OF MAX		DY HR		COOLING LOAD (KBTU/HR)		ENERGY (MBTU)		OF MAX		DY HR		HEATING LOAD (KBTU/HR)		ENERGY (KWH)		ENERGY (KWH)		ENERGY (KWH)		ENERGY (KWH)		ENERGY (KWH)		ENERGY (KWH)		ENERGY (KWH)	
MONTH		DY HR		TEMP		TEMP		TEMP		TEMP		TEMP		TEMP		TEMP		TEMP		TEMP		TEMP		TEMP		TEMP		TEMP	
MAY	0.00000	0.0000	0.000	0.000	0.000	0.000	0.000	-0.015	15	23	66.F	63.F	-1.763	0.000	0.000	5930.	28.552	10961.	28.552	10802.	28.552	11378.	28.552	10770.	28.552	225.	9.360	50065.	28.552
JUN	0.00000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JUL	0.00000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AUG	0.00000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SEP	0.00000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OCT	0.00000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.015	0.000	0.000	0.000	0.000	0.000	-1.763	0.000	50065.	28.552	50065.	28.552	50065.	28.552	50065.	28.552	50065.	28.552	50065.	28.552	50065.	28.552

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V TOPEKA, KS

-- N U M B E R O F H O U R S --										--COINCIDENT LOADS--									
COOLING		HEATING		COOL-HEAT		COINCIDENT		HEATING		HEATING		ELECTRIC		LOAD AT		LOAD AT		LOAD AT	
LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD	
MONTH		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD		LOAD	
MAY		0		0		0		0		0		0		0		0		0	
JUN		0		0		0		0		0		0		0		0		0	
JUL		0		0		0		0		0		0		0		0		0	
AUG		0		0		0		0		0		0		0		0		0	
SEP		0		0		0		0		0		0		0		0		0	
OCT		0		0		0		0		0		0		0		0		0	
ANNUAL		0		0		0		0		0		0		0		0		0	

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#3 TOPEKA, KS

COOLING				HEATING				ELEC			
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.98588	31 16	88.F	75.F	-0.049	15 6	60.F	60.F	-8.040	450.	3.913
JUN	13.00624	27 16	89.F	77.F	0.000				0.000	893.	3.913
JUL	17.45461	1 16	86.F	80.F	0.000				0.000	818.	3.913
AUG	17.79119	23 16	96.F	77.F	0.000				0.000	933.	3.913
SEP	8.56392	7 15	92.F	76.F	0.000				0.000	855.	3.913
OCT	0.04147	1 17	85.F	68.F	0.000				0.000	2.	0.065
TOTAL	60.843				-0.049				-8.040	3951.	3.913
MAX											

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#3 TOPEKA, KS

COOLING				HEATING				ELEC			
MONTH	COOLING LOAD	HOURS COOLING	COINCIDENT COOL-HEAT LOAD	HOURS HEATING	AVAIL.	HOURS COOLING	AVAIL.	HOURS HEATING	AVAIL.	COINCIDENT COOL-HEAT LOAD	AVAIL.
MAY	271	15	0	122	24	273	408	0	122	0.000	3.913
JUN	633	0	0	87	0	636	720	0	87	0.000	3.913
JUL	728	0	0	16	0	731	744	0	16	0.000	3.913
AUG	727	0	0	17	0	727	744	0	17	0.000	3.913
SEP	449	0	0	271	0	455	720	0	271	0.000	3.913
OCT	5	0	0	19	0	6	24	0	19	0.000	0.065
ANNUAL	2813	15	0	532	24	2828	3360	0	532		

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#4 TOPEKA, KS

MONTH	--- C O O L I N G ---						--- H E A T I N G ---						--- E L E C ---					
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	ELEC- MAXIMUM LOAD (KW)						
MAY	3.96382	31	16	88.F	75.F	-0.044	15	6	60.F	60.F	450.	3.913						
JUN	12.85757	27	16	89.F	77.F	0.000				0.000	893.	3.913						
JUL	17.14018	1	16	86.F	80.F	0.000				0.000	818.	3.913						
AUG	17.51623	23	16	96.F	77.F	0.000				0.000	933.	3.913						
SEP	8.53387	7	15	92.F	76.F	0.000				0.000	855.	3.913						
OCT	0.04737	1	17	85.F	68.F	0.000				0.000	2.	0.065						
TOTAL	60.059					-0.044					3951.	3.913						
MAX					51.092					-7.458								

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#4 TOPEKA, KS

9

--- N U M B E R O F H O U R S ---										--COINCIDENT LOADS--			
HOURS		HOURS		HOURS		HOURS		HOURS		HEATING		ELECTRIC	
COOLING		COOL-HEAT		COOLING		HEATING		COOLING		LOAD AT		LOAD AT	
LOAD		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
MONTH		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD		AVAIL.		AVAIL.		FANS ON		PEAK		PEAK	
		LOAD											

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#5 TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C				
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	TRICAL ENERGY (KWH)	ELEC LOAD (KW)	MAXIMUM ELEC LOAD (KW)
MAY	3.96306	31 16	88.F	75.F	41.033	-0.044	15 6	60.F	60.F	-7.460	450.		3.913
JUN	12.85682	27 16	89.F	77.F	44.825	0.000				0.000	893.		3.913
JUL	17.14048	1 16	86.F	80.F	51.092	0.000				0.000	818.		3.913
AUG	17.51656	23 16	96.F	77.F	47.241	0.000				0.000	933.		3.913
SEP	8.53241	7 15	92.F	76.F	45.529	0.000				0.000	855.		3.913
OCT	0.04718	1 17	85.F	68.F	10.742	0.000				0.000	2.		0.065
TOTAL	60.057					-0.044					3951.		3.913
MAX					51.092					-7.460			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#5 TOPEKA, KS

-- N U M B E R O F H O U R S --				--COINCIDENT LOADS--			
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS COOLING AVAIL.	HOURS HEATING AVAIL.	HOURS FLOATING LOAD AT NIGHT WHEN FANS ON CYCLE ON VENTING	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	271	16	0	121	24	408	3.913
JUN	638	0	0	82	0	720	3.913
JUL	731	0	0	13	0	744	3.913
AUG	728	0	0	16	0	744	3.913
SEP	452	0	0	268	0	720	3.913
OCT	6	0	0	18	0	24	0.065
ANNUAL	2826	16	0	518	24	3360	

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY 37.245 237.587 31/16	NATURAL-GAS 0.350 52.193 15/ 6
MAY			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	79.753 242.281 28/16	0.000 30/ 1
JUN			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	85.538 247.780 22/16	0.000 31/ 1
JUL			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	90.741 250.574 23/16	0.000 31/ 1
AUG			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	69.670 246.008 7/16	0.000 30/ 1
SEP			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	0.945 66.308 1/17	0.000 1/ 1
OCT			
	ONE YEAR USE/PEAK	363.892 250.574	0.350 52.193

D2-41

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.01	0.35
SPACE COOL	115.77	0.00
HVAC AUX	120.82	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	113.06	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	14.24	0.00
TOTAL	363.90	0.35

TOTAL SITE ENERGY 364.24 MBTU 15.5 KBTU/SQFT-YR GROSS-AREA 17.5 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1093.12 MBTU 46.5 KBTU/SQFT-YR GROSS-AREA 52.5 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 19.4
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#1 TOPEKA, KS

C O O L I N G										H E A T I N G										E L E C									
MAXIMUM										MAXIMUM										MAXIMUM									
COOLING										HEATING										TRICAL									
ENERGY (MBTU)										OF MAX (MBTU)										ENERGY (KWH)									
TIME DRY- WET- BULB										TIME DRY- WET- BULB										LOAD (KBTU/HR)									
OF MAX DY HR TEMP TEMP										OF MAX DY HR TEMP TEMP										LOAD (KBTU/HR)									
MONTH										MONTH										MONTH									
MAY	3.65217	31	16	88.F	75.F					-0.001	15	23	66.F	63.F						-0.276	434.	3.900							
JUN	10.27727	20	13	86.F	76.F					0.000										0.000	869.	3.900							
JUL	12.68210	1	16	86.F	80.F					0.000										0.000	795.	3.900							
AUG	13.99084	23	16	96.F	77.F					0.000										0.000	912.	3.900							
SEP	7.67623	7	15	92.F	76.F					0.000										0.000	829.	3.900							
OCT	0.04337	1	18	83.F	68.F					0.000										0.000	1.	0.052							
TOTAL	48.322									-0.001										-0.276	3840.	3.900							
MAX																													

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#1 TOPEKA, KS

N U M B E R O F H O U R S										C O I N C I D E N T L O A D S									
HOURS										HOURS									
COOLING										HEATING									
LOAD										LOAD AT									
HOURS COOL-HEAT										LOAD AT									
HOURS COOLING										COOLING									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOLING										PEAK									
HOURS COOL																			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#2 TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM COOLING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM HEATING LOAD (KBTU/HR)
MAY	3.68015	31 16	88.F 75.F	38.023	-0.001	15 23	66.F 63.F	-0.266	434.	3.900	434.	3.900
JUN	10.50791	20 13	86.F 76.F	40.879	0.000			0.000	869.	3.900	869.	3.900
JUL	13.01523	1 16	86.F 80.F	47.397	0.000			0.000	795.	3.900	795.	3.900
AUG	14.30785	24 16	96.F 77.F	43.983	0.000			0.000	913.	3.900	913.	3.900
SEP	7.78204	7 15	92.F 76.F	43.507	0.000			0.000	830.	3.900	830.	3.900
OCT	0.04292	1 18	83.F 68.F	13.740	0.000			0.000	1.	0.052	1.	0.052
TOTAL	49.336				-0.001			-0.266	3842.		3842.	3.900
MAX				47.397								

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#2 TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM COOLING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM HEATING LOAD (KBTU/HR)
MAY	3.68015	31 16	88.F 75.F	38.023	-0.001	15 23	66.F 63.F	-0.266	434.	3.900	434.	3.900
JUN	10.50791	20 13	86.F 76.F	40.879	0.000			0.000	869.	3.900	869.	3.900
JUL	13.01523	1 16	86.F 80.F	47.397	0.000			0.000	795.	3.900	795.	3.900
AUG	14.30785	24 16	96.F 77.F	43.983	0.000			0.000	913.	3.900	913.	3.900
SEP	7.78204	7 15	92.F 76.F	43.507	0.000			0.000	830.	3.900	830.	3.900
OCT	0.04292	1 18	83.F 68.F	13.740	0.000			0.000	1.	0.052	1.	0.052
TOTAL	49.336				-0.001			-0.266	3842.		3842.	3.900
MAX				47.397								

MONTH	COOLING				HEATING				ELEC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM COOLING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM HEATING LOAD (KBTU/HR)
MAY	3.68015	31 16	88.F 75.F	38.023	-0.001	15 23	66.F 63.F	-0.266	434.	3.900	434.	3.900
JUN	10.50791	20 13	86.F 76.F	40.879	0.000			0.000	869.	3.900	869.	3.900
JUL	13.01523	1 16	86.F 80.F	47.397	0.000			0.000	795.	3.900	795.	3.900
AUG	14.30785	24 16	96.F 77.F	43.983	0.000			0.000	913.	3.900	913.	3.900
SEP	7.78204	7 15	92.F 76.F	43.507	0.000			0.000	830.	3.900	830.	3.900
OCT	0.04292	1 18	83.F 68.F	13.740	0.000			0.000	1.	0.052	1.	0.052
TOTAL	49.336				-0.001			-0.266	3842.		3842.	3.900
MAX				47.397								

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V TOPEKA, KS

C O O L I N G				H E A T I N G				E L E C			
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	0.00000				-0.015	15 23	66.F	63.F	-1.761	5930.	28.552
JUN	0.00000				0.000				0.000	10961.	28.552
JUL	0.00000				0.000				0.000	10802.	28.552
AUG	0.00000				0.000				0.000	11378.	28.552
SEP	0.00000				0.000				0.000	10770.	28.552
OCT	0.00000				0.000				0.000	225.	9.360
TOTAL	0.000				-0.015				-1.761	50065.	28.552
MAX											

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V TOPEKA, KS

N U M B E R O F H O U R S												C O I N C I D E N T L O A D S			
HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HEATING		ELECTRIC	
COOLING	HEATING	COOL-HEAT	COINCIDENT	LOAD	FLOATING	HEATING	AVAIL.	COOLING	AVAIL.	FANS ON	CYCLE ON	NIGHT	FLOATING	LOAD AT	LOAD AT
MONTH	LOAD	LOAD	LOAD	LOAD	LOAD	AVAIL.	AVAIL.	AVAIL.	AVAIL.	FANS ON	FANS ON	VENTING	WHEN	PEAK	PEAK
MAY	0	12	0	0	396	24	0	408	0	0	0	0	396	0.000	9.360
JUN	0	0	0	0	720	0	0	720	0	0	0	0	720	0.000	9.360
JUL	0	0	0	0	744	0	0	744	0	0	0	0	744	0.000	9.360
AUG	0	0	0	0	744	0	0	744	0	0	0	0	744	0.000	9.360
SEP	0	0	0	0	720	0	0	720	0	0	0	0	720	0.000	9.360
OCT	0	0	0	0	24	0	0	24	0	0	0	0	24	0.000	9.360
ANNUAL	0	12	0	0	3348	24	0	3360	0	0	0	0	3348		

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#3 TOPEKA, KS

C O O L I N G										H E A T I N G										E L E C									
COOLING					MAXIMUM					HEATING					WET- BULB					MAXIMUM					ELEC- TRICAL				
ENERGY (MBTU)					LOAD (KBTU/HR)					OF MAX DY HR					TEMP TEMP					HEATING LOAD (KBTU/HR)					ENERGY (KWH)				
MONTH																													
MAY	3.59803	31	16	88.F	75.F	38.223				-0.001	15	23	66.F	63.F						-0.285					434.				3.900
JUN	10.45674	20	13	86.F	76.F	41.021				0.000										0.000					869.				3.900
JUL	13.07663	1	16	86.F	80.F	47.501				0.000										0.000					795.				3.900
AUG	14.31603	24	16	96.F	77.F	44.170				0.000										0.000					913.				3.900
SEP	7.66325	6	16	93.F	76.F	43.660				0.000										0.000					830.				3.900
OCT	0.03905	1	17	85.F	68.F	14.359				0.000										0.000					1.				0.052
TOTAL	49.150									-0.001															3841.				3.900
MAX						47.501														-0.285									

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#3 TOPEKA, KS

5

N U M B E R O F H O U R S															--COINCIDENT LOADS--				
MONTH	HOURS COOLING		HOURS HEATING		HOURS COOL-HEAT LOAD		HOURS HEATING AVAIL.		HOURS COOLING AVAIL.		HOURS FANS ON CYCLE		HOURS NIGHT VENTING		HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		
	LOAD		LOAD		LOAD		AVAIL.		AVAIL.		FANS ON	ON	VENTING						
MAY	191		3		0		214	24	384		201		201	0	7	0.000	3.900		
JUN	438		0		0		282	0	720		438		438	0	0	0.000	3.900		
JUL	488		0		0		256	0	744		488		488	0	0	0.000	3.900		
AUG	531		0		0		213	0	744		531		531	0	0	0.000	3.900		
SEP	344		0		0		376	0	647		417		417	0	73	0.000	3.900		
OCT	4		0		0		20	0	13		15		15	0	11	0.000	0.052		
ANNUAL 1996			3		0		1361	24	3252		2090		2090	0	91				

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#4 TOPEKA, KS

C O O L I N G										H E A T I N G										E L E C			
		TIME		WET-		MAX		COOLING		TIME		WET-		MAX		HEATING		TRICAL		ELEC		LOAD	
MONTH		OF MAX		BULB		DY		LOAD		OF MAX		BULB		DY		ENERGY		ENERGY		LOAD		LOAD	
		DY		TEMP		HR		(KBTU/HR)		DY		TEMP		HR		(KBTU/HR)		(KWH)		(KW)			
MAY	3.65819	31	16	88.F	75.F			38.071		15	23	66.F	63.F			-0.001		434.		3.900			
JUN	10.34371	20	13	86.F	76.F			41.160								0.000		869.		3.900			
JUL	12.80960	1	16	86.F	80.F			47.360								0.000		795.		3.900			
AUG	14.10292	24	16	96.F	77.F			43.912								0.000		912.		3.900			
SEP	7.70630	7	15	92.F	76.F			43.517								0.000		830.		3.900			
OCT	0.04345	1	18	83.F	68.F			13.908								0.000		1.		0.052			
TOTAL	48.664															-0.001		3841.					
MAX								47.360								-0.275							3.900

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#4 TOPEKA, KS

N U M B E R O F H O U R S										C O I N C I D E N T L O A D S									
		HOURS		COOL-HEAT		COOLING		HEATING		HOURS		FANS ON		FANS ON		HOURS		FANS ON	
MONTH		LOAD		LOAD		AVAIL.		AVAIL.		FANS ON		FANS ON		FANS ON		FANS ON		FANS ON	
		LOAD		LOAD		AVAIL.		AVAIL.		FANS ON		FANS ON		FANS ON		FANS ON		FANS ON	
MAY	197	4	0	0	207	24	384	208	208	0	0	7	0.000	3.900					
JUN	436	0	0	284	0	720	436	436	436	0	0	0	0.000	3.900					
JUL	483	0	0	261	0	744	483	483	483	0	0	0	0.000	3.900					
AUG	527	0	0	217	0	744	527	527	527	0	0	0	0.000	3.900					
SEP	351	0	0	369	0	656	415	415	415	0	64	11	0.000	3.900					
OCT	4	0	0	20	0	13	15	15	15	0	11	0.000	0.052						
ANNUAL 1998		4	0	1358	24	3261	2084	2084	2084	0	82								

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL SZ#5 TOPEKA, KS

MONTH	COOLING				HEATING				ELECTRIC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
MAY	3.65812	31 16	88.F	75.F	-0.001	15 23	66.F	63.F	-0.274	434.	3.900	
JUN	10.34339	20 13	86.F	76.F	0.000				0.000	869.	3.900	
JUL	12.80967	1 16	86.F	80.F	0.000				0.000	795.	3.900	
AUG	14.10354	24 16	96.F	77.F	0.000				0.000	912.	3.900	
SEP	7.72317	7 15	92.F	76.F	0.000				0.000	830.	3.900	
OCT	0.04329	1 18	83.F	68.F	0.000				0.000	1.	0.052	
TOTAL	48.681				-0.001				-0.274	3841.	3.900	
MAX												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL SZ#5 TOPEKA, KS

MONTH	NUMBER OF HOURS												COINCIDENT LOADS---			
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING LOAD	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		
MAY	197	4	0	0	207	24	384	208	0	7	0.000	3.900	0.000	0.000	3.900	
JUN	436	0	0	0	284	0	720	436	0	0	0.000	3.900	0.000	0.000	3.900	
JUL	483	0	0	0	261	0	744	483	0	0	0.000	3.900	0.000	0.000	3.900	
AUG	527	0	0	0	217	0	744	527	0	0	0.000	3.900	0.000	0.000	3.900	
SEP	352	0	0	0	368	0	656	416	0	64	0.000	3.900	0.000	0.000	3.900	
OCT	4	0	0	0	20	0	13	15	0	11	0.000	0.052	0.000	0.000	0.052	
ANNUAL 1999		4	0	0	1357	24	3261	2085	0	82						

MO	UTILITY -	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	33.968	0.025
MAY	PEAK(KBTU)	213.721	3.940
	DY/HR	31/16	15/23
	TOTAL(MBTU)	68.887	0.000
JUN	PEAK(KBTU)	218.684	0.000
	DY/HR	24/13	30/ 1
	TOTAL(MBTU)	71.837	0.000
JUL	PEAK(KBTU)	228.299	0.000
	DY/HR	1/16	31/ 1
	TOTAL(MBTU)	76.574	0.000
AUG	PEAK(KBTU)	223.269	0.000
	DY/HR	24/16	31/ 1
	TOTAL(MBTU)	63.800	0.000
SEP	PEAK(KBTU)	221.616	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	0.946	0.000
OCT	PEAK(KBTU)	58.538	0.000
	DY/HR	1/18	1/ 1
	ONE YEAR	316.012	0.025
	USE/PEAK	228.299	3.940

ENERGY TYPE		
IN SITE MBTU -	ELECTRICITY	NATURAL-GAS
CATEGORY OF USE		
SPACE HEAT	0.00	0.02
SPACE COOL	71.99	0.00
HVAC AUX	116.73	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	113.06	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	14.24	0.00
TOTAL	316.01	0.02

TOTAL SITE ENERGY 316.04 MBTU 13.5 KBTU/SQFT-YR GROSS-AREA 15.2 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 949.01 MBTU 40.4 KBTU/SQFT-YR GROSS-AREA 45.6 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 24.9
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 227 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	504.36	320.79	183.57	1162.89
Annual Natural Gas (MBTU)	231.80	366.27	-134.47	-851.85
Electric Demand June (KW)	32.11	27.44	4.68	29.62
Electric Demand July (KW)	34.89	30.33	4.56	28.89
Electric Demand August (KW)	33.79	29.31	4.48	28.38

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 409 (sq.ft.)	5304
ECO Model Bldg 227 (sq.ft.)	33600
Square Footage Adjustment Factor	6.335

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 227 - Replace 3 SZ & 2 MZ AHUs w/ 6 VAV AHUs

A. CONSTRUCTION COST	=	\$99,658
B. SIOH COST	(5.5% of 1A) =	\$5,481
C. DESIGN COST	(6.0% of 1A) =	\$5,979
D. TOTAL COST	(1A + 1B + 1C) =	\$111,119
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$111,119

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	1,163	\$14,071	15.88	\$223,447
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(852)	(\$3,510)	18.30	(\$64,226)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$1,527	14.88	\$22,725
F. TOTAL		311	\$12,089		-----> \$181,945

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$70,248	5	0.863	\$60,624
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$70,248			\$60,624

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$60,624

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$15,601
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.12
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$242,569
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	2.18

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST

PROJECT Fort Riley Feasibility Study for HVAC Upgrade
ENGINEER E M C Engineers, Inc.
Denver, CO

SHEET 1 OF 1
DATE PREPARED 4-May-95
ESTIMATOR C. Wohliert
CHECKED BY A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 227								
2		PROPOSED SYSTEM MODIFICATIONS								
3										
4		NEW SYSTEMS INSTALLATION								
5	AHUH1300	1,300 CFM AHU	EA.	1.0	\$2,296.53	\$2,297	Q-5	13.9965	\$271	\$2,568
6	AHUH3200	3,200 CFM AHU	EA.	2.0	\$3,023.28	\$6,047	Q-5	21	\$814	\$6,861
7	AHU12000	12,000 CFM AHU, COOLING ONLY	EA.	2.0	\$5,499.08	\$10,998	Q-6	52.174	\$2,098	\$13,096
8	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER, 3HP	EA.	3.0	\$2,238.39	\$6,715	1-ELEC	10.5	\$659	\$7,374
9	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER, 7.5HP	EA.	2.0	\$2,728.70	\$5,457	1-ELEC	12.5	\$523	\$5,981
10	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	13.0	\$287.31	\$3,735	1-SHEE	1.33	\$360	\$4,095
11	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	240.0	\$5.28	\$1,267	Q-15	0.34	\$1,582	\$2,850
12		VALVES AND FITTINGS ADD 15%				\$190			\$237	\$427
13	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THICK	L.F.	240.0	\$1.60	\$384	Q-14	0.089	\$393	\$777
14	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	4616.0	\$0.45	\$2,058	Q-10	0.087	\$7,802	\$9,860
15	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	2198.0	\$0.83	\$1,832	Q-14	0.053	\$2,145	\$3,977
16	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	13.0	\$24.23	\$315	1-ELEC	0.8	\$218	\$533
17	WIRE#12	COPPER WIRING #12	C.L.F.	6.0	\$7.41	\$44	1-ELEC	0.727	\$91	\$136
18	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	8.0	\$138.57	\$1,109	Q-5	1.32	\$205	\$1,313
19	REHEAT1.5	REHEAT COIL, 2ROW, 15"x1"	EA.	2.0	\$129.36	\$259	Q-5	1.32	\$51	\$310
20	STLPIP0.75	STEEL PIPE SCH. 40, 0.75" W/HANGERS	L.F.	300.0	\$1.51	\$453	1-PLUM	0.2	\$1,292	\$1,746
21		VALVES AND FITTINGS ADD 15%				\$68			\$194	\$262
22	INSLPIP0.75	0.75" FIBERGLASS PIPE INSULATION, 1" THICK	L.F.	300.0	\$0.61	\$183	Q-14	0.07	\$387	\$570
23										
24										
25		EXISTING SYSTEMS DEMOLITION								
26		AHU DEMOLITION	TON	2.8			Q-5	17.778	\$965	\$965
27		DUCT DEMOLITION	TON	2.3			Q-5	17.778	\$793	\$793
28		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	\$146	\$146
29										
30										
31		SUBTOTAL				\$43,411			\$21,228	\$64,639
32	OH	OVERHEAD			17%	\$7,293			\$3,566	\$10,859
33	PRO	PROFIT			10%	\$5,070			\$2,479	\$7,550
34	CONT	CONTINGENCY			20%	\$11,155			\$5,455	\$16,610
35		TOTAL COST				\$66,929			\$32,729	\$99,658

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc.							
		Denver, CO							
		SHEET 1 OF 1		DATE PREPARED 4-May-95		ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 227							
2		NON-RECURRING							
3									
4		NEW SYSTEMS INSTALLATION							
5	AHUH1300	1,300 CFM AHU	EA.	1.0	\$2,296.53	\$2,297	Q-5	13.9965	\$271
6	AHUH3200	3,200 CFM AHU	EA.	2.0	\$3,023.28	\$6,047	Q-5	21	\$814
7	AHUH12000	12,000 CFM AHU	EA.	2.0	\$6,598.89	\$13,198	Q-6	54.7827	\$2,203
8	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	256.0	\$5.28	\$1,352	Q-15	0.34	\$1,688
9		VALVES AND FITTINGS ADD 15%				\$203			\$253
10	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	256.0	\$1.60	\$409	Q-14	0.089	\$420
11	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	4616.0	\$0.45	\$2,058	Q-10	0.087	\$7,802
12	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	2198.0	\$0.83	\$1,832	Q-14	0.053	\$2,145
13	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	13.0	\$24.23	\$315	1-ELEC	0.8	\$218
14	WIRE#12	COPPER WIRING #12	C.L.F.	6.0	\$7.41	\$44	1-ELEC	0.727	\$91
15									
16									
17									
18									
19									
20		EXISTING SYSTEMS DEMOLITION							
21		AHU DEMOLITION	TON	2.8			Q-5	17.778	\$965
22		DUCT DEMOLITION	TON	2.3			Q-5	17.778	\$793
23		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	\$146
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$27,754			\$17,810
32	OH	OVERHEAD			17%	\$4,663			\$2,992
33	PRO	PROFIT			10%	\$3,242			\$2,080
34	CONT	CONTINGENCY			20%	\$7,132			\$4,576
35	TOTAL COST					\$42,789			\$27,459
									\$45,563
									\$7,655
									\$5,322
									\$11,708
									\$70,248

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1		
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED				4 May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR				C. Wohler	
										CHECKED BY				A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL					
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total						
1		BUILDING 227													
2		ANNUAL RECURRING													
3		ANNUAL MAINTENANCE COST - BASELINE													
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-		\$0	-	-	\$0	\$0					
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT													
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-		\$0	-	-	\$0	\$0					
30															
31															
32															
33															
34		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-		\$0	-	-	\$0	\$0					
35															

DEMAND LIMITING ANALYSIS BUILDING 227

1993 JUL BILL 71-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
SUMMER PEAK (KW) = 27812											
BASE CASE											
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	28.89	28.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.62
CAPACITY (KW)	32443	34424	26136	20754	26400	22752	27108	23310	21834	21996	30066
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32705	34736	26373	20775	26453	22820	27244	23404	21878	22084	30432
80% SUMMER PEAK (KVA)	27789	27789	27789	27789	27789	27789	27789	27789	27789	27789	27789
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32705	34736	27789	27789	27789	27789	27789	27789	27789	27789	30432
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,024.21	\$138,251.80	\$110,115.44	\$110,115.44	\$110,115.44	\$110,115.44	\$110,115.44	\$110,115.44	\$110,115.44	\$110,115.44	\$120,817.80
SUB DISCOUNT \$.20	(\$6,540.95)	(\$6,947.25)	(\$5,557.80)	(\$5,557.80)	(\$5,557.80)	(\$5,557.80)	(\$5,557.80)	(\$5,557.80)	(\$5,557.80)	(\$5,557.80)	(\$6,086.31)
CAPACITY CHARGE	\$126,073.27	\$133,894.55	\$107,147.64	\$107,147.64	\$107,147.64	\$107,147.64	\$107,147.64	\$107,147.64	\$107,147.64	\$107,147.64	\$117,321.49
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,166.71	\$68,152.52	\$54,522.01	\$54,522.01	\$54,522.01	\$54,522.01	\$54,522.01	\$54,522.01	\$54,522.01	\$54,522.01	\$59,706.71
100*KVA @ \$.03404	\$111,326.95	\$118,242.18	\$94,593.75	\$94,593.75	\$94,593.75	\$94,593.75	\$94,593.75	\$94,593.75	\$94,593.75	\$94,593.75	\$103,589.01
250*KVA @ \$.03084	\$252,153.58	\$267,816.46	\$210,071.30	\$184,165.70	\$214,253.17	\$214,253.17	\$214,253.17	\$214,253.17	\$212,846.90	\$171,212.90	\$234,627.29
EXCESS @ \$.02864	\$109,923.25	\$66,029.56	\$0.00	\$0.00	\$1,271.65	\$51,964.45	\$42,513.25	\$39,076.45	\$0.00	\$0.00	\$28,564.90
ENERGY CHARGE	\$537,570.49	\$520,240.72	\$359,187.06	\$333,281.46	\$364,640.58	\$415,333.38	\$405,882.18	\$402,445.38	\$361,962.66	\$320,328.66	\$426,487.92
TOTAL CHARGE LESS ECA	\$663,643.75	\$654,135.27	\$466,334.70	\$440,429.10	\$471,788.22	\$522,481.02	\$513,029.82	\$509,593.02	\$469,110.30	\$427,476.30	\$543,809.41
SUMMARY											
MONTHLY DIFFERENCE	\$159.32	\$156.65	\$105.16	\$105.16	\$125.32	\$125.32	\$125.32	\$125.32	\$105.16	\$105.16	\$164.01
ANNUAL DIFFERENCE.....		\$1,527.19									

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC
DENVER, CO 80227 EXISTING CONDITION OF BLDG 227
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT
DOE-2.1D 2/27/1995 ENL BARRACKS W/AS
TOPEKA, KS
16:58:36 LDL RUN 1

NUMBER OF EXTERIOR SURFACES	12	RECTANGULAR	12	OTHER	0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)					

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	NE ROOMS	0.490	364.00	0.231	1612.00	0.278	1976.00	NORTH-EAST
	TV/POOL_RM	0.490	36.00	0.231	164.00	0.277	200.00	NORTH-EAST
	BASE_HALL	0.490	10.50	0.231	29.50	0.299	40.00	NORTH-EAST
	BASE_HALL	0.000	0.00	0.231	68.00	0.231	68.00	SOUTH-EAST
	TV/POOL_RM	0.490	72.00	0.231	203.00	0.299	275.00	SOUTH-EAST
	SW ROOMS	0.490	364.00	0.231	1612.00	0.278	1976.00	SOUTH-WEST
	BASE_HALL	0.490	21.00	0.231	71.00	0.290	92.00	SOUTH-WEST
	SW ROOMS	0.490	56.00	0.231	334.00	0.268	390.00	NORTH-WEST
	TV/POOL_RM	0.490	72.00	0.231	203.00	0.299	275.00	NORTH-WEST
	NE ROOMS	0.490	56.00	0.231	334.00	0.268	390.00	NORTH-WEST
	SW_ROOMS	0.000	0.00	0.041	1140.00	0.041	1140.00	ROOF
	NE_ROOMS	0.000	0.00	0.041	1140.00	0.041	1140.00	ROOF
	TV/POOL_RM	0.000	0.00	0.020	1360.00	0.020	1360.00	UNDERGRND
	TV/POOL_RM	0.000	0.00	0.020	2200.00	0.020	2200.00	UNDERGRND
	BASE_HALL	0.000	0.00	0.020	207.00	0.020	207.00	UNDERGRND
	BASE_HALL	0.000	0.00	0.020	153.00	0.020	153.00	UNDERGRND
	BASE_HALL	0.000	0.00	0.020	90.00	0.020	90.00	UNDERGRND
	BASE_HALL	0.000	0.00	0.020	824.00	0.020	824.00	UNDERGRND

EMC ENGINEERS INC.	EZDOE - ELITE SOFTWARE DEVELOPMENT INC	DOE-2.1D	2/27/1995	16:58:36	LDL RUN 1
DENVER, CO	80227	EXISTING CONDITION OF BLDG 227	ENL BARRACKS W/AS		
REPORT- LV-D	DETAILS OF EXTERIOR SURFACES IN THE PROJECT		TOPEKA, KS		

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	0.490	0.231	0.279	410.50	1805.50	2216.00
SOUTH-EAST	0.490	0.231	0.285	72.00	271.00	343.00
SOUTH-WEST	0.490	0.231	0.279	385.00	1683.00	2068.00
NORTH-WEST	0.490	0.231	0.276	184.00	871.00	1055.00
ROOF	0.000	0.041	0.041	0.00	2280.00	2280.00
ALL WALLS	0.490	0.231	0.279	1051.50	4630.50	5682.00
WALLS+ROOFS	0.490	0.168	0.210	1051.50	6910.50	7962.00
UNDERGRND	0.000	0.020	0.020	0.00	4834.00	4834.00
BUILDING	0.490	0.107	0.139	1051.50	11744.50	12796.00

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:58:36 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 227 ENL BARRACKS W/AS
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 5304 SQFT 493 SQMT
VOLUME 98592 CUFT 2792 CUMT

COOLING LOAD
=====

TIME	JUL 23	5PM
DRY-BULB TEMP	97F	36C
WET-BULB TEMP	79F	26C

HEATING LOAD
=====

JAN 28	5AM
-1F	-18C
-2F	-19C

	SENSIBLE (KBTU/H) (KW)		LATENT (KBTU/H) (KW)		SENSIBLE (KBTU/H) (KW)	
WALLS	12.782	3.743	0.000	0.000	-66.921	-19.600
ROOFS	5.103	1.494	0.000	0.000	-6.980	-2.044
GLASS CONDUCTION	11.154	3.267	0.000	0.000	-39.924	-11.693
GLASS SOLAR	26.039	7.626	0.000	0.000	1.066	0.312
DOOR	0.107	0.031	0.000	0.000	-0.325	-0.095
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.868	-0.254	0.000	0.000	-2.776	-0.813
OCCUPANTS TO SPACE	13.681	4.007	23.125	6.773	11.980	3.509
LIGHT TO SPACE	16.782	4.915	0.000	0.000	4.737	1.387
EQUIPMENT TO SPACE	10.145	2.971	0.000	0.000	2.220	0.650
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000

TOTAL	94.924	27.801	23.125	6.773	-96.924	-28.387
TOTAL LOAD	118.049	KBTU/H	34.573	KW	-96.924	KBTU/H
TOTAL LOAD / AREA	22.26	BTU/H.SQFT	70.163	W /SQMT	18.274	BTU/H.SQFT

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR

* ---- LOADS

* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION

* IN CONSIDERATION

EMC ENGINEERS INC. 80227		EZDOE - ELITE SOFTWARE DEVELOPMENT INC		DOE-2.1D		2/27/1995		16:58:36		SDL RUN 1	
DENVER, CO		80227		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		TOPEKA, KS			
REPORT- SS-A		SYSTEM MONTHLY LOADS SUMMARY FOR		MZ-ZN 1&2							
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											
ENGINEERS		INC.		EXISTING CONDITION OF BLDG 227		ENL BARRACKS W/AS		DOE-2.1D		2/27/1995	
CO		80227		MZ-ZN 1&2		TOPEKA, KS					
SYSTEM MONTHLY LOADS SUMMARY FOR											

[illegible]

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:58:36 SDL RUN 1											
DENVER, CO 80227 EXISTING CONDITION OF BLDG 227 ENL BARRACKS W/AS 2/27/1995 16:58:36 SDL RUN 1											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-ZN_3&4 TOPEKA, KS											
----- C O O L I N G ----- H E A T I N G ----- E L E C -----											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-7.298	15	-8.F	-9.F	-28.440	2750.	4.665
FEB	0.00000				-4.709	3	-1.F	-2.F	-25.106	2484.	4.665
MAR	0.00000				-2.175	4	14.F	12.F	-19.573	2752.	4.665
APR	0.00000				-0.126	1	36.F	32.F	-10.550	2662.	4.665
MAY	7.74145	16	2	62.F	-0.031	8	50.F	48.F	-0.660	2750.	4.665
JUN	15.96486	19	17	87.F	0.000				0.000	2663.	4.665
JUL	19.50407	23	18	95.F	0.000				0.000	2749.	4.665
AUG	18.88764	21	17	95.F	0.000				0.000	2752.	4.665
SEP	12.93794	5	18	90.F	0.000				0.000	2662.	4.665
OCT	0.36114	1	18	83.F	-0.096	2	64.F	59.F	-8.086	2749.	4.665
NOV	0.00000				-0.776	3	13.F	12.F	-13.420	2661.	4.665
DEC	0.00000				-5.595	15	4.F	3.F	-23.745	2750.	4.665
TOTAL	75.397				-20.806					32384.	
MAX									-28.440		4.665

D3-15

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:58:36 SDL RUN 1									
DENVER, CO 80227 EXISTING CONDITION OF BLDG 227 ENL BARRACKS W/AS 2/27/1995 16:58:36 SDL RUN 1									
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-ZN_3&4 TOPEKA, KS									
----- N U M B E R O F H O U R S -----									
HOURS									
COOL-HEAT									
LOAD									
HOURS									
COOLING									
LOAD									
HOURS									
HEATING									
LOAD									
HOURS									
HEATING									
AVAIL.									
HOURS									
COOLING									
AVAIL.									
HOURS									
FANS ON									
CYCLE ON									
HOURS									
FANS ON									
NIGHT									
VENTING									
HOURS									
FLOATING									
WHEN									
FANS ON									
HOURS									
HEATING									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									
PEAK									
(KW)									
COINCIDENT LOADS--									
ELECTRIC									
LOAD AT									
COOLING									

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 35.097 57.257 31/13	NATURAL-GAS 67.345 183.575 15/ 6
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	31.528 57.257 28/10	46.392 160.067 3/ 5
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	34.121 57.257 31/10	26.932 128.400 4/ 5
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	32.164 56.339 5/ 8	4.776 78.284 1/ 1
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	43.394 109.601 31/18	1.485 10.893 10/23
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	55.226 109.598 27/19	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	61.142 119.085 23/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	61.185 115.330 21/17	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	49.030 109.246 5/18	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	33.567 92.598 1/17	4.301 66.586 20/ 8
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	32.917 57.257 30/20	22.266 117.032 3/ 5
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	34.970 57.257 31/22	58.297 161.984 15/ 2
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	504.340 119.085	231.796 183.575

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	8.52	231.80
SPACE COOL	107.48	0.00
HVAC AUX	212.29	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	111.39	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	64.67	0.00
TOTAL	504.36	231.80

TOTAL SITE ENERGY 736.14 MBTU 138.8 KBTU/SQFT-YR GROSS-AREA 138.8 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1746.33 MBTU 329.2 KBTU/SQFT-YR GROSS-AREA 329.2 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.2
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:56:41 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 227 ENL BARRACKS W/AS
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-ZN 1&2 TOPEKA, KS

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-50.464	15	-8.F	-9.F	-118.452	3133.	6.120
FEB	0.00000				0.000	-36.382	3	-5.F	-6.F	-108.924	2830.	6.210
MAR	0.00000				0.000	-25.838	4	5	14.F	-87.581	3241.	12.472
APR	0.00000				0.000	-6.608	1	1	32.F	-54.839	4418.	12.472
MAY	19.09696	16	2	62.F	117.078	-1.569	5	5	44.F	-21.968	4455.	12.472
JUN	46.86300	27	17	89.F	122.298	0.000				0.000	3698.	8.829
JUL	58.90392	23	17	97.F	132.554	0.000				0.000	4012.	9.141
AUG	56.16653	22	17	95.F	126.116	0.000				0.000	3980.	9.060
SEP	29.43439	7	18	91.F	111.677	0.000				0.000	3318.	8.548
OCT	0.47590	1	17	85.F	36.310	-6.471	20	8	23.F	-57.401	4313.	12.472
NOV	0.00000				0.000	-22.511	3	5	13.F	-84.139	3239.	12.472
DEC	0.00000				0.000	-45.281	13	8	0.F	-110.495	3133.	6.120
TOTAL	210.941					-195.124					43771.	
TAX					132.554					-118.452		12.472

D3-13

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:56:41 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 227 ENL BARRACKS W/AS
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-ZN 1&2 TOPEKA, KS

MONTH	HOURS										--COINCIDENT LOADS--	
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	
JAN	0	744	0	0	744	0	744	0	0	-60.297	0.888	
FEB	0	672	0	0	672	0	672	0	0	-56.888	0.888	
MAR	0	707	0	37	744	0	744	0	37	-53.800	0.888	
APR	0	430	0	290	720	0	720	0	290	-9.924	3.105	
MAY	384	153	0	207	360	384	744	0	207	0.000	6.937	
JUN	720	0	0	0	0	720	720	0	0	0.000	8.738	
JUL	744	0	0	0	0	744	744	0	0	0.000	9.141	
AUG	744	0	0	0	0	744	744	0	0	0.000	8.958	
SEP	720	0	0	0	0	720	720	0	0	0.000	8.548	
OCT	24	442	0	278	720	24	744	0	278	0.000	6.120	
NOV	0	655	0	65	720	0	720	0	65	-64.398	0.888	
DEC	0	744	0	0	744	0	744	0	0	-70.345	3.213	
ANNUAL	3336	4547	0	877	5424	3336	8760	0	877			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:56:41 SDL RUN 1											
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 227 ENL BARRACKS W/AS 2/22/1995 13:56:41 SDL RUN 1											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-ZN_3&4 TOPEKA, KS											
MONTH	C O O L I N G				H E A T I N G				E L E C		
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-11.552	15	6	-8.F	-9.F	1546.	3.047
FEB	0.00000				-8.524	3	5	-1.F	-2.F	1397.	3.080
MAR	0.00000				-6.068	4	5	14.F	12.F	1572.	4.437
APR	0.00000				-1.477	1	3	36.F	32.F	1901.	5.072
MAY	5.58373	16	2	62.F	59.F	1	2	44.F	41.F	1915.	5.072
JUN	12.64975	27	19	88.F	76.F					1636.	3.675
JUL	16.33679	23	18	95.F	79.F					1750.	3.793
AUG	15.86384	21	17	95.F	77.F					1755.	3.817
SEP	9.47309	5	18	90.F	77.F					1587.	3.638
OCT	0.17250	1	17	85.F	68.F					2032.	5.072
NOV	0.00000				-4.130	3	5	13.F	12.F	1589.	5.072
DEC	0.00000				-9.836	15	3	4.F	3.F	1546.	3.047
TOTAL	60.080				-43.196					20227.	
MAX											

03-14

4

EMC ENGINEERS INC. 80227 EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:56:41 SDL RUN 1												
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 227 ENL BARRACKS W/AS 2/22/1995 13:56:41 SDL RUN 1												
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-ZN_3&4 TOPEKA, KS												
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	N U M B E R O F H O U R S	HOURS COOLING AVAIL.	HOURS HEATING AVAIL.	HOURS FLOATING	HOURS NIGHT VENTING	HOURS FANS ON	HOURS FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	744	0	744	0	0	0	0	-15.264	0.393
FEB	0	672	0	672	0	672	0	0	0	0	-14.521	0.393
MAR	0	712	0	744	0	744	0	0	0	32	-14.081	0.393
APR	0	410	0	720	0	720	0	0	0	310	0.000	2.418
MAY	384	162	0	744	384	744	0	0	0	198	0.000	2.418
JUN	720	0	0	720	720	720	0	0	0	0	0.000	3.661
JUL	744	0	0	744	744	744	0	0	0	0	0.000	3.784
AUG	744	0	0	744	744	744	0	0	0	0	0.000	3.790
SEP	720	0	0	720	720	720	0	0	0	0	0.000	3.629
OCT	24	360	0	744	24	744	0	0	0	360	0.000	3.047
NOV	0	597	0	720	0	720	0	0	0	123	-15.050	0.393
DEC	0	744	0	744	0	744	0	0	0	0	-12.715	1.572
ANNUAL	3336	4401	0	8760	3336	5424	0	0	0	1023		

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY TOTAL (MBTU) PEAK (KBTU) DY/HR	NATURAL-GAS TOTAL (MBTU) PEAK (KBTU) DY/HR
JAN	18.462 34.658 31/20	18.462 34.658 31/20	89.869 198.595 15/ 6
FEB	16.624 34.658 28/20	16.624 34.658 28/20	67.815 183.873 3/ 5
MAR	18.385 55.517 12/14	18.385 55.517 12/14	50.859 153.948 4/ 5
APR	22.287 60.155 3/22	22.287 60.155 3/22	14.780 105.059 1/ 1
MAY	30.111 92.125 31/18	30.111 92.125 31/18	4.011 43.720 6/ 5
JUN	37.593 93.638 27/19	37.593 93.638 27/19	0.000 0.000 30/ 1
JUL	43.913 100.040 21/17	43.913 100.040 21/17	0.000 0.000 31/ 1
AUG	30.184 91.658 7/18	30.184 91.658 7/18	0.000 0.000 30/ 1
SEP	22.638 59.903 13/10	22.638 59.903 13/10	14.242 105.067 20/ 5
OCT	18.194 59.761 23/14	18.194 59.761 23/14	43.090 147.190 3/ 5
NOV	18.433 34.658 31/22	18.433 34.658 31/22	81.603 182.819 15/ 2
DEC	320.790 103.518	320.790 103.518	366.270 198.595
ONE YEAR USE/PEAK			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:56:41 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 227 ENL BARRACKS W/AS TOPEKA, KS
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	12.42	366.27
SPACE COOL	89.86	0.00
HVAC AUX	42.46	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	111.39	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	64.67	0.00
TOTAL	320.79	366.27

TOTAL SITE ENERGY 687.06 MBTU 129.5 KBTU/SQFT-YR GROSS-AREA 129.5 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1329.60 MBTU 250.7 KBTU/SQFT-YR GROSS-AREA 250.7 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 12.1
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDINGS 402, 410 ANNUAL ENERGY SAVINGS SUMMARY

(PER BUILDING)

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	504.36	320.79	183.57	996.76
Annual Natural Gas (MBTU)	231.80	366.27	-134.47	-730.15
Electric Demand June (KW)	32.11	27.44	4.68	25.39
Electric Demand July (KW)	34.89	30.33	4.56	24.77
Electric Demand August (KW)	33.79	29.31	4.48	24.33

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 409 (sq.ft.)	5304
ECO Model Bldg 402 (sq.ft.)	28800
Square Footage Adjustment Factor	5.430

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 402 - Replace 1 SZ & 2 MZ AHUs w/ 3 VAV AHUs

A. CONSTRUCTION COST	=	\$70,718
B. SIOH COST	(5.5% of 1A) =	\$3,889
C. DESIGN COST	(6.0% of 1A) =	\$4,243
D. TOTAL COST	(1A + 1B + 1C) =	\$78,851
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$78,851

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	997	\$12,061	15.88	\$191,525
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(730)	(\$3,008)	18.30	(\$55,050)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$1,309	14.88	\$19,478
F. TOTAL		267	\$10,362		-----> \$155,953

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$0
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST				\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$49,221	5	0.863	\$42,478
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$49,221			\$42,478

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$42,478

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$12,823
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	6.15
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$198,431
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	2.52

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT Fort Riley Feasibility Study for HVAC Upgrade									
ENGINEER E M C Engineers, Inc.									
Denver, CO									
SHEET 1 OF 1									
DATE PREPARED 4-May-95									
ESTIMATOR C. Wohler									
CHECKED BY A. Niemeyer									
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 402							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5	AHU1300	1,300 CFM AHU	EA.	1.0	\$2,296.53	\$2,297	Q-5	13.9965	\$271
6	AHU10000	10,000 CFM AHU, COOLING ONLY	EA.	1.0	\$4,820.78	\$4,821	Q-6	44.444	\$894
7	AHU12000	12,000 CFM AHU, COOLING ONLY	EA.	1.0	\$5,499.08	\$5,499	Q-6	52.174	\$1,049
8	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER, 3HP	EA.	1.0	\$2,238.39	\$2,238	1-ELEC	10.5	\$220
9	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER, 7.5HP	EA.	2.0	\$2,728.70	\$5,457	1-ELEC	12.5	\$523
10	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	11.0	\$287.31	\$3,160	1-SHEE	1.33	\$304
11	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	154.0	\$5.28	\$813	Q-15	0.34	\$1,015
12		VALVES AND FITTINGS ADD 15%				\$122			\$152
13	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	154.0	\$1.60	\$246	Q-14	0.089	\$252
14	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	3290.0	\$0.45	\$1,466	Q-10	0.087	\$5,561
15	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	1566.7	\$0.83	\$1,306	Q-14	0.053	\$1,529
16	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	11.0	\$24.23	\$266	1-ELEC	0.8	\$184
17	WIRE#12	COPPER WIRING #12	C.L.F.	5.1	\$7.41	\$38	1-ELEC	0.727	\$78
18	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	8.0	\$138.57	\$1,109	Q-5	1.32	\$205
19	REHEAT1.5	REHEAT COIL, 2ROW, 1.5"x1"	EA.	2.0	\$129.36	\$259	Q-5	1.32	\$51
20	STLPIP0.75	STEEL PIPE SCH. 40, 0.75" W/HANGERS	L.F.	300.0	\$1.51	\$453	1-PLUM	0.2	\$1,292
21		VALVES AND FITTINGS ADD 15%				\$68			\$194
22	INSLPIP0.75	0.75" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	300.0	\$0.61	\$183	Q-14	0.07	\$387
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26		AHU DEMOLITION	TON	2.8			Q-5	17.778	\$965
27		DUCT DEMOLITION	TON	2.3			Q-5	17.778	\$793
28		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	\$146
29									
30									
31		SUBTOTAL				\$29,802			\$16,066
32	OH	OVERHEAD			17%	\$5,007			\$2,699
33	PRO	PROFIT			10%	\$3,481			\$1,877
34	CONT	CONTINGENCY			20%	\$7,658			\$4,128
35	TOTAL COST					\$45,948			\$24,770

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade			SHEET		1		OF	
ENGINEER		E M C Engineers, Inc.			DATE PREPARED		4-May-95		ESTIMATOR	
		Denver, CO			CHECKED BY		A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			Total	TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total		
1		BUILDING 402								
2		NON-RECURRING								
3										
4		NEW SYSTEMS INSTALLATION								
5	AHUH1300	1,300 CFM AHU	EA.	1.0	\$2,296.53	\$2,297	Q-5	13.9965	\$271	\$2,568
6	AHUH10000	10,000 CFM AHU	EA.	1.0	\$5,784.93	\$5,785	Q-6	46.6662	\$938	\$6,723
7	AHUH12000	12,000 CFM AHU	EA.	1.0	\$6,598.89	\$6,599	Q-6	54.7827	\$1,101	\$7,700
8	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	154.0	\$5.28	\$813	Q-15	0.34	\$1,015	\$1,829
9		VALVES AND FITTINGS ADD 15%				\$122			\$152	\$274
10	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THICK	L.F.	154.0	\$1.60	\$246	Q-14	0.089	\$252	\$499
11	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	3290.0	\$0.45	\$1,466	Q-10	0.087	\$5,561	\$7,027
12	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	1566.7	\$0.83	\$1,306	Q-14	0.053	\$1,529	\$2,835
13	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	11.0	\$24.23	\$266	1-ELEC	0.8	\$184	\$451
14	WIRE#12	COPPER WIRING #12	C.L.F.	5.1	\$7.41	\$38	1-ELEC	0.727	\$78	\$115
15										
16										
17										
18										
19										
20		EXISTING SYSTEMS DEMOLITION								
21		AHU DEMOLITION	TON	2.8			Q-5	17.778	\$965	\$965
22		DUCT DEMOLITION	TON	2.3			Q-5	17.778	\$793	\$793
23		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	\$146	\$146
24										
25										
26										
27										
28										
29										
30										
31		SUBTOTAL				\$18,938			\$12,987	\$31,925
32	OH	OVERHEAD			17%	\$3,182			\$2,182	\$5,363
33	PRO	PROFIT			10%	\$2,212			\$1,517	\$3,729
34	CONT	CONTINGENCY			20%	\$4,866			\$3,337	\$8,204
35		TOTAL COST				\$29,198			\$20,023	\$49,221

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF	1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95		
						ESTIMATOR		C. Wohler		
						CHECKED BY		A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 402								
2		ANNUAL RECURRING								
3		ANNUAL MAINTENANCE COST - BASELINE								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0	\$0
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT								
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0	\$0
30										
31										
32										
33										
34										
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0	\$0

DEMAND LIMITING ANALYSIS BUILDING 402

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	24.77	24.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.39
CAPACITY (KW)	32447	34428	26136	20754	26400	22752	27108	25812	23310	21834	21996	30071
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32709	34740	26373	20775	26453	22820	27244	25916	23404	21878	22084	30436
80% SUMMER PEAK (KVA)	27792	27792	27792	27792	27792	27792	27792	27792	27792	27792	27792	27792
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32709	34740	27792	27792	27792	27792	27792	27792	27792	27792	27792	30436
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,041.07	\$138,268.37	\$110,128.69	\$110,128.69	\$110,128.69	\$110,128.69	\$110,128.69	\$110,128.69	\$110,128.69	\$110,128.69	\$110,128.69	\$120,835.15
SUB DISCOUNT \$.20	(\$6,541.78)	(\$6,948.07)	(\$5,558.45)	(\$5,558.45)	(\$5,558.45)	(\$5,558.45)	(\$5,558.45)	(\$5,558.45)	(\$5,558.45)	(\$5,558.45)	(\$5,558.45)	(\$6,087.17)
CAPACITY CHARGE	\$126,089.28	\$133,910.30	\$107,160.24	\$107,160.24	\$107,160.24	\$107,160.24	\$107,160.24	\$107,160.24	\$107,160.24	\$107,160.24	\$107,160.24	\$117,337.98
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,174.87	\$68,160.54	\$54,528.43	\$54,528.43	\$54,528.43	\$54,528.43	\$54,528.43	\$54,528.43	\$54,528.43	\$54,528.43	\$54,528.43	\$59,715.12
100*KVA @ \$.03404	\$111,341.11	\$118,256.11	\$94,604.89	\$94,604.89	\$94,604.89	\$94,604.89	\$94,604.89	\$94,604.89	\$94,604.89	\$94,604.89	\$94,604.89	\$103,603.60
250*KVA @ \$.03084	\$252,185.66	\$267,848.00	\$210,056.16	\$184,150.56	\$214,278.40	\$214,278.40	\$214,278.40	\$214,278.40	\$214,278.40	\$212,831.76	\$171,197.76	\$234,660.32
EXCESS @ \$.02864	\$109,875.58	\$65,982.69	\$0.00	\$0.00	\$1,234.15	\$51,926.95	\$42,475.75	\$33,024.55	\$39,038.95	\$0.00	\$0.00	\$28,515.83
ENERGY CHARGE	\$537,577.23	\$520,247.35	\$359,189.48	\$333,283.88	\$364,645.88	\$415,338.68	\$405,887.48	\$396,436.28	\$402,450.68	\$361,965.08	\$320,331.08	\$426,494.86
TOTAL CHARGE LESS ECA	\$663,666.51	\$654,157.65	\$466,349.72	\$440,444.12	\$471,806.12	\$522,498.92	\$513,047.72	\$503,596.52	\$509,610.92	\$469,125.32	\$427,491.32	\$543,832.84
SUMMARY												
MONTHLY DIFFERENCE	\$136.56	\$134.27	\$90.13	\$90.13	\$107.41	\$107.41	\$107.41	\$107.41	\$107.41	\$90.13	\$90.13	\$140.58
ANNUAL DIFFERENCE.....		\$1,309.02	\$90.13	\$90.13	\$107.41	\$107.41	\$107.41	\$107.41	\$107.41	\$90.13	\$90.13	

BUILDINGS 402, 410 ANNUAL ENERGY SAVINGS SUMMARY

(PER BUILDING)

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	504.36	320.79	183.57	996.76
Annual Natural Gas (MBTU)	231.80	366.27	-134.47	-730.15
Electric Demand June (KW)	32.11	27.44	4.68	25.39
Electric Demand July (KW)	34.89	30.33	4.56	24.77
Electric Demand August (KW)	33.79	29.31	4.48	24.33

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 409 (sq.ft.)	5304
ECO Model Bldg 402 (sq.ft.)	28800
Square Footage Adjustment Factor	5.430

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE: 05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 410 - Replace 3 MZ AHUs w/ 3 VAV AHUs

A. CONSTRUCTION COST	=	\$69,518
B. SIOH COST	(5.5% of 1A) =	\$3,823
C. DESIGN COST	(6.0% of 1A) =	\$4,171
D. TOTAL COST	(1A + 1B + 1C) =	\$77,512
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$77,512

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	997	\$12,061	15.88	\$191,525
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(730)	(\$3,008)	18.30	(\$55,050)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$1,309	14.88	\$19,478
F. TOTAL		267	\$10,362		-----> \$155,953

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$0
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST				\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$51,813	5	0.863	\$44,714
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$51,813			\$44,714

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$44,714

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$12,952
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	5.98
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$200,668
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.59

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 410							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5	AHU3200	3,200 CFM AHU, COOLING ONLY	EA.	1.0	\$2,519.40	\$2,519	Q-5	20	\$388
6	AHU12000	12,000 CFM AHU, COOLING ONLY	EA.	2.0	\$5,499.08	\$10,998	Q-6	52.174	\$2,098
7	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER, 3HP	EA.	1.0	\$2,238.39	\$2,238	1-ELEC	10.5	\$220
8	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER, 7.5HP	EA.	2.0	\$2,728.70	\$5,457	1-ELEC	12.5	\$523
9	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	2.0	\$271.32	\$543	1-SHEE	1.13	\$47
10	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	5.0	\$287.31	\$1,437	1-SHEE	1.33	\$138
11	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	170.0	\$5.28	\$898	Q-15	0.34	\$1,121
12		VALVES AND FITTINGS ADD 15%				\$135			\$168
13	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THICK	L.F.	170.0	\$1.60	\$272	Q-14	0.089	\$279
14	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	3500.0	\$0.45	\$1,560	Q-10	0.087	\$5,916
15	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	1167.0	\$0.83	\$973	Q-14	0.053	\$1,139
16	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	8.0	\$24.23	\$194	1-ELEC	0.8	\$134
17	WIRE#12	COPPER WIRING #12	C.L.F.	3.7	\$7.41	\$27	1-ELEC	0.727	\$56
18	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	5.0	\$138.57	\$693	Q-5	1.32	\$128
19	REHEAT1.5	REHEAT COIL, 2ROW, 1.5"x1"	EA.	2.0	\$129.36	\$259	Q-5	1.32	\$51
20	STLPIP0.75	STEEL PIPE SCH. 40, 0.75" W/HANGERS	L.F.	300.0	\$1.51	\$453	1-PLUM	0.2	\$1,292
21		VALVES AND FITTINGS ADD 15%				\$68			\$194
22	INSLPIP0.75	0.75" FIBERGLASS PIPE INSULATION, 1" THICK	L.F.	300.0	\$0.61	\$183	Q-14	0.07	\$387
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26		AHU DEMOLITION	TON	2.8			Q-5	17.778	\$965
27		DUCT DEMOLITION	TON	2.3			Q-5	17.778	\$793
28		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	\$146
29									
30									
31		SUBTOTAL				\$28,907			\$16,183
32	OH	OVERHEAD			17%	\$4,856			\$2,719
33	PRO	PROFIT			10%	\$3,376			\$1,890
34	CONT	CONTINGENCY			20%	\$7,428			\$4,158
35	TOTAL COST					\$44,567			\$24,950
									\$45,090
									\$7,575
									\$5,266
									\$11,586
									\$69,518

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF 1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95	
						ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 410							
2		NON-RECURRING							
3									
4		NEW SYSTEMS INSTALLATION							
5	AHUH3200	3,200 CFM AHU	EA.	1.0	\$3,023.28	Q-5	21	\$407	\$3,430
6	AHUH12000	12,000 CFM AHU	EA.	2.0	\$6,598.89	Q-6	54.7827	\$2,203	\$15,401
7	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	170.0	\$5.28	Q-15	0.34	\$1,121	\$2,019
8		VALVES AND FITTINGS ADD 15%						\$168	\$303
9	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	170.0	\$1.60	Q-14	0.089	\$279	\$550
10	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	3500.0	\$0.45	Q-10	0.087	\$5,916	\$7,476
11	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	1167.0	\$0.83	Q-14	0.053	\$1,139	\$2,112
12	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	8.0	\$24.23	1-ELEC	0.8	\$134	\$328
13	WIRE#12	COPPER WIRING #12	C.L.F.	3.7	\$7.41	1-ELEC	0.727	\$56	\$84
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26		AHU DEMOLITION	TON	2.8		Q-5	17.778	\$965	\$965
27		DUCT DEMOLITION	TON	2.3		Q-5	17.778	\$793	\$793
28		PIPING DEMOLITION 2-4"	L.F.	128.0		1-PLUM	0.053	\$146	\$146
29									
30									
31		SUBTOTAL			\$20,279			\$13,327	\$33,606
32	OH	OVERHEAD			17%			\$2,239	\$5,646
33	PRO	PROFIT			10%			\$1,557	\$3,925
34	CONT	CONTINGENCY			20%			\$3,425	\$8,635
35		TOTAL COST			\$31,266			\$20,547	\$51,813

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED		4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR		C. Wohler	
										CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			Total	TOTAL		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total				
1		BUILDING 410											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	-	\$0	\$0		
16													
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	-	\$0	\$0		
30													
31													
32													
33													
34		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	-	\$0	\$0		
35													



BUILDING 7404 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1362.38	998.60	363.78	363.78
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	192.01	182.14	9.87	9.87
Electric Demand July (KW)	198.34	191.68	6.66	6.66
Electric Demand August (KW)	201.02	194.26	6.76	6.76

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7810 (sq.ft.)	41892
ECO Model Bldg 7404 (sq.ft.)	41892
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 7404 - Convert Existing (2) Cooling only MZs to VAV Cooling AHUs						
A.	CONSTRUCTION COST	=				\$23,368
B.	SIOH COST	(5.5% of 1A) =				\$1,285
C.	DESIGN COST	(6.0% of 1A) =				\$1,402
D.	TOTAL COST	(1A + 1B + 1C) =				\$26,055
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =					\$0
F.	PUBLIC UTILITY COMPANY REBATE =					\$0
G.	TOTAL INVESTMENT	(1D - 1E - 1F) =			----->	\$26,055
2. ENERGY SAVINGS (+) OR COST (-):						
DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:				<u>JAN '95</u>		
	ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A.	ELECT.	\$12.10	364	\$4,402	15.88	\$69,900
B.	DIST	\$0.00	0	\$0	19.16	\$0
C.	NAT GAS	\$4.12	0	\$0	18.30	\$0
D.	COAL	\$0.00	0	\$0	16.62	\$0
E.	ELEC. DEMAND			\$378	14.88	\$5,629
F.	TOTAL		364	\$4,780		-----> \$75,529
3. NON-ENERGY SAVINGS (+) OR COST (-)						
A. ANNUAL RECURRING (+/-)						
1	ANNUAL MAINTENANCE			\$0	14.88	\$0
2				\$0	14.88	\$0
3				\$0	14.88	\$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST			\$0		\$0
B. NON-RECURRING (+/-)						
	ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)	
				(TABLE A-2)		
a.	BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0	
b.					\$0	
c.					\$0	
d.					\$0	
e.					\$0	
f.	TOTAL	\$0			\$0	
C.	TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)			(3A4 + 3Bf4) =		\$0
4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)			(2F3 + 3A4 + (3Bf1/Economic Life))		\$4,780
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)			(1G/4) =		5.45
6.	TOTAL NET DISCOUNTED SAVINGS			(2F5 + 3C) =		\$75,529
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)			(6/1G) =		2.90
	(MUST HAVE SIR > 1.25 TO QUALIFY)					

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade			SHEET		1		OF
ENGINEER		E M C Engineers, Inc. Denver, CO			DATE PREPARED		4-May-95		
					ESTIMATOR		C. Wohler		
					CHECKED BY		A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7404							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		BLANK OFF HOT DECK	EA.	1.0	\$50.00	\$50	1-CLAB	3	\$43
5	VSD20	VARIABLE SPEED DRIVE W/ CONTRLER,20HP	EA.	2.0	\$4,844.03	\$9,688	1-ELEC	19	\$795
6	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	12.0	\$24.23	\$291	1-ELEC	0.8	\$201
7	WIRE#12	COPPER WIRING #12	C.L.F.	9.5	\$7.41	\$70	1-ELEC	0.727	\$145
8	VAVCNTL2	VAV BOX CONTROLLER & ACTUATOR, ELEC	EA.	12.0	\$155.04	\$1,860	1-ELEC	0.33	\$83
9	CNTV2.5	CONTROL VALVE 2-1/2"	EA.	2.0	\$935.09	\$1,870	1-PLUM	3.556	\$153
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$13,780			\$1,377
32	OH	OVERHEAD			17%	\$2,315			\$231
33*	PRO	PROFIT			10%	\$1,609			\$161
34	CONT	CONTINGENCY			20%	\$3,541			\$354
35	TOTAL COST					\$21,245			\$2,123
									\$15,157
									\$2,546
									\$1,770
									\$3,895
									\$23,368

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT										DATE PREPARED			
ENGINEER										ESTIMATOR			
										CHECKED BY			
Fort Riley Feasibility Study for HVAC Upgrade										4-May-95			
E M C Engineers, Inc.										C. Wohler			
Denver, CO										A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	TOTAL			
1		BUILDING 7404											
2		NON-RECURRING											
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32	OH	SUBTOTAL			17%	\$0			\$0	\$0			
33	PRO	OVERHEAD			10%	\$0			\$0	\$0			
34	CONT	PROFIT			20%	\$0			\$0	\$0			
35	TOTAL COST	CONTINGENCY				\$0			\$0	\$0			

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF 1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95	
						ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7404							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0

DEMAND LIMITING ANALYSIS BUILDING 7404

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	6.66	6.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.87
CAPACITY (KW)	32465	34445	26136	20754	26400	22752	27108	25812	23310	21834	21996	30086
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32727	34758	26373	20775	26453	22820	27244	25916	23404	21878	22084	30452
80% SUMMER PEAK (KVA)	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32727	34758	27806	27806	27806	27806	27806	27806	27806	27806	27806	30452
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,114.98	\$138,340.13	\$110,186.11	\$110,186.11	\$110,186.11	\$110,186.11	\$110,186.11	\$110,186.11	\$110,186.11	\$110,186.11	\$110,186.11	\$120,898.78
SUB DISCOUNT \$.20	(\$6,545.43)	(\$6,951.61)	(\$5,561.29)	(\$5,561.29)	(\$5,561.29)	(\$5,561.29)	(\$5,561.29)	(\$5,561.29)	(\$5,561.29)	(\$5,561.29)	(\$5,561.29)	(\$6,090.31)
CAPACITY CHARGE	\$126,159.55	\$133,978.52	\$107,214.82	\$107,214.82	\$107,214.82	\$107,214.82	\$107,214.82	\$107,214.82	\$107,214.82	\$107,214.82	\$107,214.82	\$117,398.47
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,210.68	\$68,195.31	\$54,556.25	\$54,556.25	\$54,556.25	\$54,556.25	\$54,556.25	\$54,556.25	\$54,556.25	\$54,556.25	\$54,556.25	\$59,745.94
100*KVA @ \$.03404	\$111,403.24	\$118,316.43	\$94,653.14	\$94,653.14	\$94,653.14	\$94,653.14	\$94,653.14	\$94,653.14	\$94,653.14	\$94,653.14	\$94,653.14	\$103,657.08
250*KVA @ \$.03084	\$252,326.37	\$267,984.63	\$209,990.58	\$184,084.98	\$214,387.70	\$214,387.70	\$214,387.70	\$214,387.70	\$214,387.70	\$212,766.18	\$171,132.18	\$234,781.46
EXCESS @ \$.02864	\$109,666.51	\$65,779.69	\$0.00	\$0.00	\$1,071.75	\$51,764.55	\$42,313.35	\$32,862.15	\$38,876.55	\$0.00	\$0.00	\$28,335.83
ENERGY CHARGE	\$537,606.79	\$520,276.05	\$359,199.97	\$333,294.37	\$364,668.84	\$415,361.64	\$405,910.44	\$396,459.24	\$402,473.64	\$361,975.57	\$320,341.57	\$426,520.31
TOTAL CHARGE LESS ECA	\$663,766.34	\$654,254.58	\$466,414.79	\$440,509.19	\$471,883.66	\$522,576.46	\$513,125.26	\$503,674.06	\$509,688.46	\$469,190.39	\$427,556.39	\$543,918.79
SUMMARY												
MONTHLY DIFFERENCE	\$36.74	\$37.34	\$25.07	\$25.07	\$29.87	\$29.87	\$29.87	\$29.87	\$29.87	\$25.07	\$25.07	\$54.63
ANNUAL DIFFERENCE.....												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/27/1995 16:50:36 LDL RUN 1
 DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7404 ENL MEN BARRACKS W/O DIN
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 9 RECTANGULAR 9 OTHER 0
 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS+OPAQUE AREA (SQFT)	AZIMUTH
EXTER-N		0.487	2205.00	0.258	6315.00	0.317	8520.00	0.317	8520.00	NORTH
EXTER-E		0.487	35.10	0.258	1665.90	0.263	1701.00	0.263	1701.00	EAST
EXTER-S		0.487	2205.00	0.258	6315.00	0.317	8520.00	0.317	8520.00	SOUTH
EXTER-W		0.487	35.10	0.258	1665.90	0.263	1701.00	0.263	1701.00	WEST
EXTER-S		0.000	0.00	0.064	4985.00	0.064	4985.00	0.064	4985.00	ROOF
EXTER-N		0.000	0.00	0.064	4560.00	0.064	4560.00	0.064	4560.00	ROOF
EXTER-E		0.000	0.00	0.064	805.00	0.064	805.00	0.064	805.00	ROOF
inter-zone		0.000	0.00	0.064	2803.00	0.064	2803.00	0.064	2803.00	ROOF
EXTER-W		0.000	0.00	0.064	805.00	0.064	805.00	0.064	805.00	ROOF
inter-zone		0.000	0.00	0.020	2803.00	0.020	2803.00	0.020	2803.00	UNDERGRND
EXTER-N		0.000	0.00	0.020	4560.00	0.020	4560.00	0.020	4560.00	UNDERGRND
EXTER-S		0.000	0.00	0.020	4985.00	0.020	4985.00	0.020	4985.00	UNDERGRND
EXTER-E		0.000	0.00	0.020	805.00	0.020	805.00	0.020	805.00	UNDERGRND
EXTER-W		0.000	0.00	0.020	805.00	0.020	805.00	0.020	805.00	UNDERGRND

D3-35

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/27/1995 16:50:36 LDL RUN 1
 DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7404 ENL MEN BARRACKS W/O DIN
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.487	0.258	0.317	2205.00	6315.00	8520.00
EAST	0.487	0.258	0.263	35.10	1665.90	1701.00
SOUTH	0.487	0.258	0.317	2205.00	6315.00	8520.00
WEST	0.487	0.258	0.263	35.10	1665.90	1701.00
ROOF	0.000	0.064	0.064	0.00	13958.00	13958.00
ALL WALLS	0.487	0.258	0.308	4480.20	15961.80	20442.00
WALLS+ROOFS	0.487	0.167	0.209	4480.20	29919.80	34400.00
UNDERGRND	0.000	0.020	0.020	0.00	13958.00	13958.00
BUILDING	0.487	0.120	0.154	4480.20	43877.80	48358.00

*** BUILDING ***

COOLING LOAD

TIME	AUG 24	7PM
DRY-BULB TEMP	92F	33C
WET-BULB TEMP	76F	24C

=====

HEATING	LOAD
SEP 18	2AM
50F	10C
48F	9C

=====

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	69.083	20.233	0.000	0.000	-79.915	-23.405
ROOFS	19.337	5.663	0.000	0.000	-13.227	-3.874
GLASS CONDUCTION	40.916	11.983	0.000	0.000	-56.113	-16.434
GLASS SOLAR	99.635	29.181	0.000	0.000	17.386	5.092
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.321	-0.387	0.000	0.000	-0.975	-0.286
OCCUPANTS TO SPACE	27.009	7.910	46.875	13.729	47.028	13.773
LIGHT TO SPACE	104.108	30.491	0.000	0.000	26.734	7.830
EQUIPMENT TO SPACE	96.808	28.353	0.000	0.000	16.306	4.776
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	188.739	55.277	318.441	93.264	-197.574	-57.865
TOTAL	644.316	188.704	365.316	106.992	-240.350	-70.393
TOTAL LOAD	1009.632	KBTU/H	295.696	KW	-70.393	
TOTAL LOAD / AREA	72.33BTU/H.SQFT		228.034	W / SQMT	17.220BTU/H.SQFT	54.285

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* --- LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:50:36 SDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7404 ENL MEN BARRACKS W/O DIN
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MULTIZONE TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	161.81717	16	62.F	59.F	1134.931	-0.288	15	70.F	67.F	-49.900	27523.	98.953
JUN	354.96619	19	86.F	75.F	916.070	0.000				0.000	48571.	98.953
JUL	416.69571	2	84.F	77.F	899.956	0.000				0.000	50190.	98.953
AUG	410.92154	24	92.F	76.F	962.199	0.000				0.000	50190.	98.953
SEP	276.45010	5	90.F	77.F	956.819	0.000				0.000	48571.	98.953
OCT	6.72422	1	83.F	68.F	581.717	0.000				0.000	1619.	98.953
TOTAL	1627.575					-0.288				-49.900	226666.	
MAX					1134.931							98.953

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:50:36 SDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7404 ENL MEN BARRACKS W/O DIN
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MULTIZONE TOPEKA, KS

MONTH	H O U R S				H O U R S				H O U R S				C O I N C I D E N T				C O I N C I D E N T			
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	384	24	0	0	24	384	408	0	0	0	0.000	33.650	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JUN	720	0	0	0	0	720	720	0	0	0	0.000	98.953	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JUL	744	0	0	0	0	744	744	0	0	0	0.000	98.953	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AUG	744	0	0	0	0	744	744	0	0	0	0.000	98.953	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SEP	718	0	0	2	0	720	720	0	0	2	0.000	80.199	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OCT	24	0	0	0	0	24	24	0	0	0	0.000	98.953	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ANNUAL	3334	24	0	2	24	3336	3360	0	0	2										

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:50:36 PDL RUN 1
 DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7404 ENL MEN BARRACKS W/O DIN TOPEKA, KS
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 151.589 655.699 30/18	NATURAL-GAS 0.393 62.791 15/10
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	292.314 655.320 19/19	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	318.959 676.933 23/18	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	322.331 686.085 24/18	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	268.994 674.782 5/18	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	8.206 575.078 1/18	0.000 0.000 1/ 1
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	1362.394 686.085	0.393 62.791

D3-38

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:50:36 PDL RUN 1
 DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7404 ENL MEN BARRACKS W/O DIN TOPEKA, KS
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE

ENERGY TYPE	IN SITE MBTU -	ELECTRICITY	NATURAL-GAS
CATEGORY OF USE			
SPACE HEAT	0.01		0.39
SPACE COOL	546.36		0.00
HVAC AUX	385.11		0.00
DOM HOT WTR	0.00		0.00
AUX SOLAR	0.00		0.00
LIGHTS	234.87		0.00
VERT TRANS	0.00		0.00
MISC EQUIP	196.04		0.00
TOTAL	1362.38		0.39

TOTAL SITE ENERGY 1362.79 MBTU 32.5 KBTU/SQFT-YR GROSS-AREA 97.6 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 4091.67 MBTU 97.7 KBTU/SQFT-YR GROSS-AREA 293.1 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.9
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:31:29 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7404 ENL MEN BARRACKS W/O DIN
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MULTIZONE TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	118.78535	30 18	86. F	75. F	866.743	-0.033	15 21	72. F	66. F	-16.410	17712.	93.788
JUN	281.88159	19 19	86. F	75. F	900.604	0.000				0.000	32504.	96.036
JUL	344.92856	23 18	95. F	79. F	882.972	0.000				0.000	34718.	98.602
AUG	343.75177	24 19	92. F	76. F	969.348	0.000				0.000	35291.	98.923
SEP	199.53497	5 18	90. F	77. F	942.876	0.000				0.000	30834.	97.697
OCT	3.94326	1 18	83. F	68. F	448.498	0.000				0.000	988.	78.754
TOTAL	1292.827					-0.033					152047.	
MAX					969.348					-16.410		98.923

EMC	ENGINEERS	INC.	EZDOE - ELITE SOFTWARE DEVELOPMENT INC	DOE-2.1D	2/22/1995	13:31:29	SDL RUN 1
DENVER,	CO	80227	PROPOSED MODIFICATION OF BLDG. 7404	ENL MEN BARRACKS	W/O DIN		
REPORT- SS-C	SYSTEM MONTHLY LOAD HOURS FOR		MULTIZONE	TOPEKA, KS			

MONTH	HOURS COOLING LOAD		HOURS HEATING LOAD		HOURS COINCIDENT COOL-HEAT LOAD		N U M B E R O F		H O U R S		HOURS NIGHT VENTING		HOURS FLOATING WHEN FANS ON		--COINCIDENT LOADS-- HEATING AT COOLING PEAK (KBTU/HR)		ELECTRIC COOLING PEAK (KW)	
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS ON CYCLE	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HOURS FANS ON	HOURS FANS ON	HOURS FANS ON	HOURS FANS ON	HOURS FANS ON	HOURS FANS ON
MAY	384	24	0	0	0	0	24	384	408	0	0	0	0	0	0	0.000	92.433	0.000
JUN	720	0	0	0	0	0	0	720	720	0	0	0	0	0	0	0.000	96.036	0.000
JUL	744	0	0	0	0	0	0	744	744	0	0	0	0	0	0	0.000	98.192	0.000
AUG	744	0	0	0	0	0	0	744	744	0	0	0	0	0	0	0.000	98.877	0.000
SEP	720	0	0	0	0	0	0	720	720	0	0	0	0	0	0	0.000	96.651	0.000
OCT	24	0	0	0	0	0	0	24	24	0	0	0	0	0	0	0.000	78.754	0.000
ANNUAL	3336	24	0	0	0	0	24	3336	3360	0	0	0	0	0	0			

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:31:29 PDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7404 ENL MEN BARRACKS W/O DIN
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 105.473 603.061 30/18	NATURAL-GAS 0.049 20.649 15/21
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	214.473 621.643 19/19	0.000 0.000 30/1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	241.729 654.195 23/18	0.000 0.000 31/1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	247.745 662.997 24/18	0.000 0.000 31/1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	184.054 644.015 5/18	0.000 0.000 30/1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	5.132 421.177 1/18	0.000 0.000 1/1
OCT	ONE YEAR USE/PEAK	998.606 662.997	0.049 20.649

D3-40

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:31:29 PDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7404 ENL MEN BARRACKS W/O DIN
REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.00	0.05
SPACE COOL	443.48	0.00
HVAC AUX	124.22	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	234.87	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	196.04	0.00
TOTAL	998.60	0.05

TOTAL SITE ENERGY 998.66 MBTU 23.8 KBTU/SQFT-YR GROSS-AREA 71.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2998.87 MBTU 71.6 KBTU/SQFT-YR GROSS-AREA 214.9 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 4.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.1
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDINGS 7612, 7614, 7616, 7810, 7814 ANNUAL ENERGY SAVINGS SUMMARY

(PER BUILDING)

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1951.46	1856.36	95.10	95.10
Annual Natural Gas (MBTU)	3450.29	1274.67	2175.62	2175.62
Electric Demand June (KW)	149.08	167.37	-18.29	-18.29
Electric Demand July (KW)	155.78	179.18	-23.40	-23.40
Electric Demand August (KW)	156.02	179.66	-23.65	-23.65

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7612 (sq.ft.)	41892
ECO Model Bldg 7612 (sq.ft.)	41892
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohlert

1. INVESTMENT: BLDG 7612 - Replace Fan Coils w/ 6 VAV AHUs

A. CONSTRUCTION COST	=		\$389,740
B. SIOH COST	(5.5% of 1A) =		\$21,436
C. DESIGN COST	(6.0% of 1A) =		\$23,384
D. TOTAL COST	(1A + 1B + 1C) =		\$434,560
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=		\$0
F. PUBLIC UTILITY COMPANY REBATE	=		\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =		-----> \$434,560

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	95	\$1,151	15.88	\$18,273
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	2,176	\$8,964	18.30	\$164,033
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			(\$1,233)	14.88	(\$18,347)
F. TOTAL		2,271	\$8,881		-----> \$163,959

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	\$5,147	14.88	\$76,588
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$5,147		\$76,588

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$179,196	5	0.863	\$154,646
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$179,196			\$154,646

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$231,234

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$22,988
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	18.90
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$395,193
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	0.91

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1		OF 1	
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95	
						ESTIMATOR		C. Wohliert	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 7612							
2		PROPOSED SYSTEM MODIFICATIONS							
3		NEW SYSTEMS INSTALLATION							
4	AHUH540	5,400 CFM AHU, COMBINATION COIL	EA.	6.0	\$4,563.99	\$27,384	Q-6	31.5	\$3,800
5	DUCT500	GAL. STEEL DUCTWORK	LB.	16600.0	\$0.45	\$7,399	Q-10	0.087	\$28,058
6	12"RDUC	12 IN. DIA. ROUND DUCT, GAL. STL	L.F.	120.0	\$2.73	\$328	Q-9	0.133	\$299
7	8"RDUC	8 IN. DIA. ROUND DUCT, GAL. STL	L.F.	900.0	\$1.79	\$1,613	Q-9	0.08	\$1,350
8	6"RDUC	6 IN. DIA. ROUND DUCT, GAL. STL	L.F.	168.0	\$1.37	\$230	Q-9	0.057	\$179
9	DTINSL0.	0.5" FIBERGLASS LINER, 2LB DENSITY	S.F.	8330.0	\$0.37	\$3,067	Q-14	0.042	\$6,443
10	9X9DIFF	9X9 SA DIFFUSERS	EA.	42.0	\$56.69	\$2,381	1-SHEE	0.571	\$499
11	12X6SA	12X6 SA GRILLES	EA.	84.0	\$9.84	\$826	1-SHEE	0.348	\$608
12	14X6SA	14X6 RA GRILLES	EA.	84.0	\$10.85	\$912	1-SHEE	0.348	\$608
13	STLPIP4	STEEL PIPE SCH. 40, 4" WHANGERS	L.F.	800.0	\$9.16	\$7,326	Q-15	0.432	\$6,701
14	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" WHANGERS	L.F.	960.0	\$5.28	\$5,070	Q-15	0.34	\$6,329
15		VALVES AND FITTINGS ADD 15%				\$1,859			\$1,955
16	INSLPIP4	4" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	800.0	\$1.89	\$1,512	Q-14	0.114	\$1,680
17	INSLPIP2.	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	960.0	\$1.60	\$1,535	Q-14	0.089	\$1,573
18	10"VAVDP	10" VAV ROUND MOTORIZED DAMPER, ELEC	EA.	78.0	\$300.87	\$23,468	1-SHEE	0.444	\$721
19	VSD5	VARIABLE SPEED DRIVE W/ CONTRLER,5HP	EA.	6.0	\$2,444.79	\$14,669	1-ELEC	10.5	\$1,318
20	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	78.0	\$24.23	\$1,890	1-ELEC	0.8	\$1,306
21	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	500.0	\$0.83	\$417	1-ELEC	0.064	\$670
22	WIRE#6	COPPER WIRING #6	C.L.F.	25.0	\$24.71	\$618	1-ELEC	1.231	\$644
23	PMP3HP	PUMP, 3 HP	EA	2.0	\$944.78	\$1,890	Q-1	6.975	\$270
24	PMP5HP	PUMP, 5 HP	EA	2.0	\$1,114.35	\$2,229	Q-1	8.889	\$345
25									
26		EXISTING SYSTEMS DEMOLITION							
27		FAN COIL DEMOLITION	E.A.	92.0			Q-5	0.5	\$3,122
28		DUAL TEMP. WATER PIPING DEMOLITION	L.F.	3300.0			1-PLUM	0.04	\$2,843
29		3-SPEED FAN SWITCH DEMOLITION	EA.	92.0			Q-5	0.44	\$2,747
30		ASBESTOS REMOVAL	L.S.	1.0					\$72,100
31		SUBTOTAL				\$106,620			\$74,069
32	OH	OVERHEAD			17%	\$17,912			\$12,444
33	PRO	PROFIT			10%	\$12,453			\$8,651
34	CONT	CONTINGENCY			20%	\$27,397			\$19,033
35		TOTAL COST				\$164,383			\$114,196
									\$389,740

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET		1	OF	1	
ENGINEER		E M C Engineers, Inc. Denver, CO		DATE PREPARED		4-May-95			
				ESTIMATOR		C. Wohler			
				CHECKED BY		A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	TOTAL
1		BUILDING 7612							
2		NON-RECURRING							
3									
4		BASELINE - EXISTING EQUIP. REPLACEMENT							
5	FC-1TON	FAN COIL, CW, CABINET, 1 TON	EA.	92.0	\$673.46	Q-6	2.667	\$4,933	\$66,891
6	CUPI0.7	COPPER PIPE TYPE L, 0.75" W/HANGERS	L.F.	2400.0	\$1.84	1-PLUM	0.105	\$5,427	\$9,846
7		VALVES AND FITTINGS ADD 15%			\$663			\$814	\$1,477
8	CUPI2	COPPER PIPE TYPE L, 2" W/HANGERS	L.F.	600.0	\$5.96	1-PLUM	0.19	\$2,455	\$6,031
9		VALVES AND FITTINGS ADD 15%			\$536			\$368	\$905
10	CUPI3	COPPER PIPE TYPE L, 3" W/HANGERS	L.F.	300.0	\$11.19	Q-1	0.286	\$1,664	\$5,021
11		VALVES AND FITTINGS ADD 15%			\$504			\$250	\$753
12	INSLPIP0.	0.75" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	2400.0	\$0.61	Q-14	0.07	\$3,094	\$4,559
13	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	600.0	\$1.46	Q-14	0.084	\$928	\$1,806
14	INSLPIP3	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	300.0	\$1.66	Q-14	0.094	\$519	\$1,016
15	PMP3HP	PUMP, 3 HP	EA	1.0	\$944.78	Q-1	6.975	\$135	\$1,080
16	PMP2ND	PUMP, 2 HP, NO DEMO	EA	1.0	\$867.26	Q-1	5.333	\$103	\$971
17	PMP1.5HP	PUMP, 1.5 HP	EA	2.0	\$843.03	Q-1	5.333	\$207	\$1,893
18	3SWTCH	3-SPEED FAN SWITCH	EA.	92.0	\$14.54	1-ELEC	0.667	\$1,284	\$2,621
19	AHUH320	3,200 CFM AHU	EA.	2.0	\$3,023.28	Q-5	21	\$814	\$6,861
20		EXISTING SYSTEMS DEMOLITION							
21		FAN COIL DEMOLITION	TON	3.5		Q-5	14.545	\$987	\$987
22		DUAL TEMP. WATER PIPING DEMOLITION	L.F.	3300.0		1-PLUM	0.04	\$2,843	\$2,843
23		3-SPEED FAN SWITCH DEMOLITION	EA.	92.0		Q-5	0.2	\$357	\$357
24		DUAL TEMP. WATER PUMP DEMOLITION	EA.	4.0		Q-5	4	\$310	\$310
25									
26									
27									
28									
29									
30									
31		SUBTOTAL			\$88,734			\$27,493	\$116,228
32	OH	OVERHEAD			17%			\$4,619	\$19,526
33	PRO	PROFIT			10%			\$3,211	\$13,575
34	CONT	CONTINGENCY			20%			\$7,065	\$29,866
35		TOTAL COST			\$136,807			\$42,388	\$179,196

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT				SHEET 1 OF 1			DATE PREPARED 4-May-95		
ENGINEER				Fort Riley Feasibility Study for HVAC Upgrade			ESTIMATOR C. Wohliert		
				E M C Engineers, Inc.			CHECKED BY A. Niemeyer		
				Denver, CO					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7612							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-FCs	MAINT. ON FCs - INSPEC. / YR	EA.	92.0	\$0.00	\$0	Q-6	4	\$7,399
5	MNT-AHU	MAINT. ON AHU - INSPEC. / YR <= 5000 CFM	EA.	2.0	\$0.00	\$0	Q-6	19	\$764
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$8,163
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17		ANNUAL MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.	6.0			Q-6	25	\$3,016
18	MNT-AHU								
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$3,016
30									
31									
32									
33									
34		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$5,147
35									

DEMAND LIMITING ANALYSIS BUILDING 7612

	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
SUMMER PEAK (KW) = 27812												
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	(23.40)	(23.65)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(18.29)
CAPACITY (KW)	32495	34476	26136	20754	26400	22752	27108	25812	23310	21834	21996	30114
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32757	34789	26373	20775	26453	22820	27244	25916	23404	21878	22084	30480
80% SUMMER PEAK (KVA)	27831	27831	27831	27831	27831	27831	27831	27831	27831	27831	27831	27831
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32757	34789	27831	27831	27831	27831	27831	27831	27831	27831	27831	30480
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,237.73	\$138,464.42	\$110,285.54	\$110,285.54	\$110,285.54	\$110,285.54	\$110,285.54	\$110,285.54	\$110,285.54	\$110,285.54	\$110,285.54	\$121,014.19
SUB DISCOUNT \$.20	(\$6,551.49)	(\$6,957.75)	(\$5,566.20)	(\$5,566.20)	(\$5,566.20)	(\$5,566.20)	(\$5,566.20)	(\$5,566.20)	(\$5,566.20)	(\$5,566.20)	(\$5,566.20)	(\$6,096.01)
CAPACITY CHARGE	\$126,276.24	\$134,096.67	\$107,309.34	\$107,309.34	\$107,309.34	\$107,309.34	\$107,309.34	\$107,309.34	\$107,309.34	\$107,309.34	\$107,309.34	\$117,508.18
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,270.14	\$68,255.52	\$54,604.42	\$54,604.42	\$54,604.42	\$54,604.42	\$54,604.42	\$54,604.42	\$54,604.42	\$54,604.42	\$54,604.42	\$59,801.85
100*KVA @ \$.03404	\$111,506.41	\$118,420.89	\$94,736.71	\$94,736.71	\$94,736.71	\$94,736.71	\$94,736.71	\$94,736.71	\$94,736.71	\$94,736.71	\$94,736.71	\$103,754.08
250*KVA @ \$.03084	\$252,560.05	\$268,221.23	\$209,877.01	\$183,971.41	\$214,576.99	\$214,576.99	\$214,576.99	\$214,576.99	\$214,576.99	\$212,652.61	\$171,018.61	\$235,001.16
EXCESS @ \$.02864	\$109,319.30	\$65,428.12	\$0.00	\$0.00	\$790.50	\$51,483.30	\$42,032.10	\$32,580.90	\$38,595.30	\$0.00	\$0.00	\$28,009.39
ENERGY CHARGE	\$537,655.89	\$520,325.77	\$359,218.14	\$333,312.54	\$364,708.62	\$415,401.42	\$405,950.22	\$396,499.02	\$402,513.42	\$361,993.74	\$320,359.74	\$426,566.48
TOTAL CHARGE LESS ECA	\$663,932.13	\$654,422.44	\$466,527.48	\$440,621.88	\$472,017.95	\$522,710.75	\$513,259.55	\$503,808.35	\$509,822.75	\$469,303.08	\$427,669.08	\$544,074.65
SUMMARY												
MONTHLY DIFFERENCE	(\$129.05)	(\$130.53)	(\$87.62)	(\$87.62)	(\$104.42)	(\$104.42)	(\$104.42)	(\$104.42)	(\$104.42)	(\$87.62)	(\$87.62)	(\$101.24)
ANNUAL DIFFERENCE.....		(\$1,233)										

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/27/1995 16:44:58 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS TOPEKA, KS
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

NUMBER OF EXTERIOR SURFACES 9 RECTANGULAR 9 OTHER 0
 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALLS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALLS AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)	AZIMUTH
EXTER-N		0.487	2205.00	0.258	6315.00	0.317	8520.00	0.317	8520.00	8520.00	NORTH
EXTER-E		0.487	35.10	0.258	1665.90	0.263	1701.00	0.263	1701.00	1701.00	EAST
EXTER-S		0.487	2205.00	0.258	6315.00	0.317	8520.00	0.317	8520.00	8520.00	SOUTH
EXTER-W		0.487	35.10	0.258	1665.90	0.263	1701.00	0.263	1701.00	1701.00	WEST
EXTER-N		0.000	0.00	0.064	4985.00	0.064	4985.00	0.064	4985.00	4985.00	ROOF
EXTER-E		0.000	0.00	0.064	4560.00	0.064	4560.00	0.064	4560.00	4560.00	ROOF
EXTER-S		0.000	0.00	0.064	805.00	0.064	805.00	0.064	805.00	805.00	ROOF
EXTER-W		0.000	0.00	0.064	2803.00	0.064	2803.00	0.064	2803.00	2803.00	ROOF
inter-zone		0.000	0.00	0.020	2803.00	0.020	2803.00	0.020	2803.00	2803.00	UNDERGRND
EXTER-N		0.000	0.00	0.020	4560.00	0.020	4560.00	0.020	4560.00	4560.00	UNDERGRND
EXTER-S		0.000	0.00	0.020	4985.00	0.020	4985.00	0.020	4985.00	4985.00	UNDERGRND
EXTER-E		0.000	0.00	0.020	805.00	0.020	805.00	0.020	805.00	805.00	UNDERGRND
EXTER-W		0.000	0.00	0.020	805.00	0.020	805.00	0.020	805.00	805.00	UNDERGRND

D3-47

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/27/1995 16:44:58 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS TOPEKA, KS
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.487	0.258	0.317	2205.00	6315.00	8520.00
EAST	0.487	0.258	0.263	35.10	1665.90	1701.00
SOUTH	0.487	0.258	0.317	2205.00	6315.00	8520.00
WEST	0.487	0.258	0.263	35.10	1665.90	1701.00
ROOF	0.000	0.064	0.064	0.00	13958.00	13958.00
ALL WALLS	0.487	0.258	0.308	4480.20	15961.80	20442.00
WALLS+ROOFS	0.487	0.167	0.209	4480.20	29919.80	34400.00
UNDERGRND	0.000	0.020	0.020	0.00	13958.00	13958.00
BUILDING	0.487	0.120	0.154	4480.20	43877.80	48358.00

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/27/1995 16:44:58 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS TOPEKA, KS
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA 13958 SQFT 1297 SQMT
VOLUME 418734 CUFT 11859 CUMT

TIME
DRY-BULB TEMP
WET-BULB TEMP

COOLING LOAD
AUG 24 7PM
92F 33C
76F 24C

HEATING LOAD
JAN 4 3AM
8F -13C
7F -14C

	SENSIBLE (KBTU/H)	(KW)	LATENT (KBTU/H)	(KW)	SENSIBLE (KBTU/H)	(KW)
WALLS	69.083	20.233	0.000	0.000	-230.041	-67.373
ROOFS	19.337	5.663	0.000	0.000	-39.155	-11.467
GLASS CONDUCTION	40.916	11.983	0.000	0.000	-151.937	-44.499
GLASS SOLAR	99.635	29.181	0.000	0.000	6.654	1.949
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.321	-0.387	0.000	0.000	-6.405	-1.876
OCCUPANTS TO SPACE	27.009	7.910	46.875	13.729	46.820	13.712
LIGHT TO SPACE	104.108	30.491	0.000	0.000	24.551	7.190
EQUIPMENT TO SPACE	96.808	28.353	0.000	0.000	14.187	4.155
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	196.190	57.459	331.012	96.945	-685.158	-200.666
TOTAL	651.766	190.886	377.887	110.674	-1020.485	-298.875
TOTAL LOAD	1029.653	KBTU/H	301.560	KW	-1020.485	KW
TOTAL LOAD / AREA	73.77	BTU/H.SQFT	232.555	W / SQMT	73.112	BTU/H.SQFT

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS TOPEKA, KS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL-T-NTH

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C		
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				0.000	-127.578	4	3	8.F	7.F	-419.091	11007.	26.108
FEB	0.00000				0.000	-92.447	1	23	17.F	15.F	-347.282	9942.	26.108
MAR	0.00000				0.000	-69.998	3	4	16.F	13.F	-325.802	11007.	26.108
APR	0.00000				0.000	-18.511	4	10	34.F	31.F	-203.407	10652.	26.108
MAY	40.54721	30	18	86.F	75.F	-2.729	5	4	45.F	41.F	-99.964	11007.	26.108
JUN	88.30765	19	12	85.F	75.F	0.000				0.000	0.000	10652.	26.108
JUL	101.69906	13	12	88.F	78.F	0.000				0.000	0.000	11007.	26.108
AUG	100.69477	24	18	93.F	76.F	0.000				0.000	0.000	11007.	26.108
SEP	63.66305	5	17	90.F	77.F	0.000				0.000	0.000	10652.	26.108
OCT	1.22654	1	18	83.F	68.F	-15.332	19	7	41.F	39.F	-185.669	11007.	26.108
NOV	0.00000				0.000	-51.368	30	5	29.F	26.F	-231.386	10652.	26.108
DEC	0.00000				0.000	-115.159	8	10	24.F	22.F	-354.947	11007.	26.108
TOTAL	396.139					-493.122						129605.	
MAX					200.296						-419.091		26.108

D3-49

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS TOPEKA, KS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL-T-NTH

MONTH	N U M B E R O F H O U R S										COINCIDENT LOADS	
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	743	0	1	744	0	744	0	0	1	-155.714	2.506
FEB	0	672	0	0	672	0	672	0	0	0	-140.158	2.506
MAR	0	703	0	41	744	0	744	0	0	41	-149.153	2.506
APR	0	460	0	260	720	0	720	0	0	260	-14.835	2.506
MAY	381	176	0	187	384	384	744	0	0	187	0.000	26.108
JUN	718	0	0	2	720	720	720	0	0	2	0.000	20.159
JUL	744	0	0	0	744	744	744	0	0	0	0.000	20.159
AUG	744	0	0	0	744	744	744	0	0	0	0.000	26.108
SEP	667	0	0	53	720	720	720	0	0	53	0.000	20.159
OCT	21	446	0	277	24	24	744	0	0	277	0.000	26.108
NOV	0	639	0	81	720	0	720	0	0	81	-164.833	2.506
DEC	0	744	0	0	744	0	744	0	0	0	-144.155	2.506
ANNUAL	3275	4583	0	902	5424	3336	8760	0	0	902		

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 SDL RUN 1											
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS 16:44:58											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR FRESH-AIR TOPEKA, KS											
----- C O O L I N G ----- H E A T I N G ----- E L E C -----											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-275.932	15	-8.F	-9.F	-601.311	6491.	12.635
FEB	0.00000				-217.831	3	-5.F	-6.F	-573.665	5859.	12.635
MAR	0.00000				-186.542	4	14.F	12.F	-500.475	6486.	12.535
APR	0.00000				-80.912	5	30.F	28.F	-341.169	6277.	12.535
MAY	18.82696	31 18	90.F	76.F	-25.446	1	37.F	37.F	-268.456	8304.	42.546
JUN	75.58569	28 18	89.F	76.F	0.000				0.000	13431.	42.019
JUL	114.85028	17 18	88.F	80.F	0.000				0.000	17194.	45.385
AUG	118.19416	20 13	92.F	78.F	0.000				0.000	17939.	44.783
SEP	42.68930	5 18	90.F	77.F	0.000				0.000	10379.	42.836
OCT	0.59765	1 18	83.F	68.F	-76.166	20	23.F	22.F	-398.804	6546.	25.289
NOV	0.00000				-157.041	3	13.F	12.F	-501.894	6277.	12.535
DEC	0.00000				-253.968	13	2.F	1.F	-532.632	6486.	12.635
TOTAL	370.744				-1273.837					111669.	
MAX									-601.311		45.385

D3-50

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1											
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS 16:44:58											
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR FRESH-AIR TOPEKA, KS											
----- N U M B E R O F H O U R S -----											
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	0	0	0	-325.292	4.970
FEB	0	672	0	0	672	0	0	0	0	-332.784	4.970
MAR	0	744	0	0	744	0	0	0	0	-323.657	4.970
APR	0	646	0	74	720	0	0	0	74	-175.473	4.970
MAY	187	277	0	280	744	189	0	0	280	0.000	42.546
JUN	523	0	0	197	720	524	0	0	197	0.000	42.019
JUL	685	0	0	59	744	685	0	0	59	0.000	44.587
AUG	671	0	0	73	744	671	0	0	73	0.000	40.155
SEP	355	0	0	365	720	356	0	0	365	0.000	42.836
OCT	7	614	0	123	744	7	0	0	123	0.000	25.289
NOV	0	707	0	13	720	0	0	0	13	-382.034	4.970
DEC	0	744	0	0	744	0	0	0	0	-360.888	4.970
ANNUAL	2428	5148	0	1184	5424	2432	0	0	1184		

EMC ENGINEERS DENVER, CO		INC. 80227		EZDOE - ELITE SOFTWARE DEVELOPMENT INC EXISTING CONDITION OF BLDG. 7612		DOE-2.1D		2/27/1995		16:44:58		SDL RUN 1	
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR				DUAL-T-STH				ENL BARRACKS W/AS TOPEKA, KS					
C O O L I N G				H E A T I N G				E L E C					
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				0.000	-92.696	4	3	8.F	7.F	12032.	28.539	
FEB	0.00000				0.000	-64.016	1	23	17.F	15.F	10868.	28.539	
MAR	0.00000				0.000	-53.417	3	4	16.F	13.F	12032.	28.539	
APR	0.00000				0.000	-16.234	4	10	34.F	31.F	11644.	28.539	
MAY	43.86287	30	18	86.F	213.081	-2.803	5	4	45.F	41.F	12032.	28.539	
JUN	94.51183	19	12	85.F	204.705	0.000				0.000	11644.	28.539	
JUL	109.83134	22	18	93.F	199.783	0.000				0.000	12032.	28.539	
AUG	110.24451	24	18	93.F	218.844	0.000				0.000	12032.	28.539	
SEP	74.63847	5	17	90.F	219.894	0.000				0.000	11644.	28.539	
OCT	2.04625	1	17	85.F	185.575	-11.790	31	7	43.F	39.F	12032.	28.539	
NOV	0.00000				0.000	-28.048	2	4	17.F	15.F	11644.	28.539	
DEC	0.00000				0.000	-88.307	8	10	24.F	22.F	12032.	28.539	
TOTAL	435.134					-357.311					141673.		
MAX					219.894					-447.087		28.539	

EMC DENVER, REPORT- SS-C		ENGINEERS CO		INC. 80227		EDOE - ELITE SOFTWARE DEVELOPMENT INC EXISTING CONDITION OF BLDG. 7612 DUAL-T-STH		DOE-2.1D ENL BARRACKS W/AS TOPEKA, KS		2/27/1995		16:44:58		SDL RUN 1	
SYSTEM MONTHLY LOAD HOURS FOR		N U M B E R		O F		H O U R S									
HOURS COINCIDENT COOL-HEAT LOAD		HOURS HEATING AVAIL.		HOURS COOLING AVAIL.		HOURS ON CYCLE ON VENTING FANS ON		HOURS FLOATING WHEN FANS ON		HEATING COOL AT PEAK (KBTU/HR)		ELECTRIC LOAD AT COOLING PEAK (KW)			
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS ON CYCLE ON VENTING FANS ON	HOURS FLOATING WHEN FANS ON	HOURS HEATING COOL AT PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)						
JAN	0	651	0	744	0	744	0	0	93	-31.133	2.740				
FEB	0	598	0	672	0	672	0	0	74	-62.445	2.740				
MAR	0	602	0	744	0	744	0	0	142	-117.518	2.740				
APR	0	424	0	720	0	720	0	0	296	-16.190	2.740				
MAY	381	175	0	360	384	744	0	0	188	0.000	28.539				
JUN	718	0	0	0	720	720	0	0	2	0.000	22.036				
JUL	744	0	0	0	744	744	0	0	0	0.000	28.539				
AUG	744	0	0	0	744	744	0	0	0	0.000	28.539				
SEP	675	0	0	0	720	720	0	0	45	0.000	22.036				
OCT	21	409	0	720	24	744	0	0	314	0.000	22.036				
NOV	0	497	0	720	0	720	0	0	223	-120.045	2.740				
DEC	0	667	0	744	0	744	0	0	77	-146.343	2.740				
ANNUAL	3283	4023	0	5424	3336	8760	0	0	1454						

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL-T-EST TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				-21.876	4 3	8.F	7.F	-71.246	1944.	4.612	
FEB	0.00000				-16.241	1 23	17.F	15.F	-58.627	1756.	4.612	
MAR	0.00000				-13.134	3 4	16.F	13.F	-54.865	1944.	4.612	
APR	0.00000				-3.909	4 10	34.F	31.F	-35.930	1882.	4.612	
MAY	5.87551	30 18	86.F	75.F	-0.605	5 4	45.F	41.F	-17.170	1944.	4.612	
JUN	13.44574	19 19	86.F	75.F	0.000				0.000	1882.	4.612	
JUL	16.09243	13 12	88.F	78.F	0.000				0.000	1944.	4.612	
AUG	16.44134	24 18	93.F	76.F	0.000				0.000	1944.	4.612	
SEP	10.02919	5 17	90.F	77.F	0.000				0.000	1882.	4.612	
OCT	0.14817	1 18	83.F	68.F	-2.670	19 10	38.F	34.F	-30.813	1944.	4.612	
NOV	0.00000				-8.885	30 4	32.F	28.F	-37.601	1882.	4.612	
DEC	0.00000				-19.858	8 10	24.F	22.F	-61.888	1944.	4.612	
TOTAL	62.032				-87.179					22892.		
MAX									-71.246		4.612	

D3-52

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL-T-EST TOPEKA, KS

MONTH	HOURS				NUMBER	OF	HOURS				--COINCIDENT LOADS--			
	COOLING LOAD	HEATING LOAD	COOL-HEAT LOAD	FLOATING			HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	
JAN	0	743	0	1	744	0	744	0	0	1	-24.627	0.442		
FEB	0	672	0	0	672	0	672	0	0	0	-22.368	0.442		
MAR	0	732	0	12	744	0	744	0	0	12	-25.287	0.442		
APR	0	495	0	225	720	0	720	0	0	225	-1.703	0.442		
MAY	381	190	0	173	360	384	744	0	0	173	0.000	4.612		
JUN	718	0	0	2	0	720	720	0	0	2	0.000	4.612		
JUL	744	0	0	0	0	744	744	0	0	0	0.000	3.562		
AUG	744	0	0	0	0	744	744	0	0	0	0.000	3.562		
SEP	663	0	0	57	720	720	720	0	0	57	0.000	3.562		
OCT	21	449	0	274	720	24	744	0	0	274	0.000	4.612		
NOV	0	647	0	73	720	0	720	0	0	73	-27.386	0.442		
DEC	0	744	0	0	744	0	744	0	0	0	-24.632	0.442		
ANNUAL	3271	4672	0	817	5424	3336	8760	0	0	817				

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL-T-WST TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-21.993	4	3	8.F	7.F	1944.	4.612
FEB	0.00000				0.000	-16.236	1	23	17.F	15.F	1756.	4.612
MAR	0.00000				0.000	-13.160	3	4	16.F	13.F	1944.	4.612
APR	0.00000				0.000	-4.019	4	10	34.F	31.F	1882.	4.612
MAY	5.99942	30 18	86.F	75.F	33.052	-0.602	5	4	45.F	41.F	1944.	4.612
JUN	13.38736	19 19	86.F	75.F	31.817	0.000				0.000	1882.	4.612
JUL	16.42722	2 19	84.F	77.F	31.019	0.000				0.000	1944.	4.612
AUG	16.46956	24 19	92.F	76.F	34.142	0.000				0.000	1944.	4.612
SEP	9.97905	5 17	90.F	77.F	34.189	0.000				0.000	1882.	4.612
OCT	0.13856	1 18	83.F	68.F	14.685	-2.682	19 10	38.F	34.F	-30.884	1944.	4.612
NOV	0.00000				0.000	-8.876	30 4	32.F	28.F	-37.428	1882.	4.612
DEC	0.00000				0.000	-19.836	8 10	24.F	22.F	-61.898	1944.	4.612
TOTAL	62.401					-87.404					22892.	
MAX					34.189					-71.220		4.612

D3-53

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL-T-WST TOPEKA, KS

MONTH	N U M B E R O F				H O U R S				C O I N C I D E N T				L O A D S			
	COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		
JAN	0	743	0	1	744	0	0	0	0	-24.242	0.442		-24.242	0.442		
FEB	0	672	0	0	672	0	0	0	0	-22.266	0.442		-22.266	0.442		
MAR	0	731	0	13	744	0	0	0	13	-23.291	0.442		-23.291	0.442		
APR	0	504	0	216	720	0	0	0	216	-1.333	0.442		-1.333	0.442		
MAY	381	201	0	162	744	384	0	0	162	0.000	4.612		0.000	4.612		
JUN	718	0	0	2	720	720	0	0	2	0.000	4.612		0.000	4.612		
JUL	744	0	0	0	744	744	0	0	0	0.000	4.612		0.000	4.612		
AUG	744	0	0	0	744	744	0	0	0	0.000	4.612		0.000	4.612		
SEP	668	0	0	52	720	720	0	0	52	0.000	3.562		0.000	3.562		
OCT	21	456	0	267	720	24	0	0	267	0.000	4.612		0.000	4.612		
NOV	0	644	0	76	720	0	0	0	76	-26.203	0.442		-26.203	0.442		
DEC	0	744	0	0	744	0	0	0	0	-24.625	0.442		-24.625	0.442		
ANNUAL	3276	4695	0	789	5424	3336	0	0	789							

MO	UTILITY - TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 143.212 301.008 28/ 9	NATURAL-GAS 768.787 1936.545 4/ 3
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	129.072 301.008 3/ 8	601.310 1672.482 1/23
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	139.326 300.667 31/20	513.112 1635.401 3/ 4
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	124.354 300.667 14/ 9	206.353 1108.685 4/10
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	157.428 511.359 31/18	57.730 723.223 5/ 4
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	205.236 508.818 28/18	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	232.826 531.671 23/18	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	237.293 532.480 21/19	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	178.932 523.004 5/18	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	128.742 426.283 1/18	184.673 1001.149 19/10
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	132.196 300.667 30/20	399.989 1290.148 2/ 4
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	142.824 301.008 13/ 8	718.337 1723.529 14/ 8
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	1951.440 532.480	3450.290 1936.545

EMC ENGINEERS INC. 80227 EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	132.94	3450.29
SPACE COOL	427.44	0.00
HVAC AUX	267.62	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	612.35	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	511.11	0.00
TOTAL	1951.46	3450.29

TOTAL SITE ENERGY 5401.73 MBTU 1364.1 KBTU/SQFT-YR GROSS-AREA 387.0 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 9310.47 MBTU 2351.1 KBTU/SQFT-YR GROSS-AREA 667.0 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 17.0
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 11:34:22 SDL RUN 1											
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG #7612 ENL MEN BARRACKS W/O DIN											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR PROP-VAV TOPEKA, KS											
----- C O O L I N G ----- H E A T I N G ----- E L E C -----											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-230.714	15	4	-8.F	-614.450	29637.	82.714
FEB	0.00000				-166.827	3	4	0.F	-548.597	26767.	82.714
MAR	0.00000				-120.777	3	4	16.F	-491.173	30432.	100.015
APR	0.00000				-29.423	5	4	32.F	-295.141	35631.	106.051
MAY	117.93249	16	2	62.F	-6.820	5	4	45.F	-138.672	36793.	106.051
JUN	282.72684	19	19	86.F	0.000				0.000	33136.	92.331
JUL	349.56494	23	19	94.F	0.000				0.000	35417.	95.645
AUG	340.51385	24	18	93.F	0.000				0.000	35553.	95.857
SEP	195.13922	6	18	91.F	0.000				0.000	31050.	92.173
OCT	3.98969	1	18	83.F	-19.250	20	3	25.F	-280.845	36428.	106.051
NOV	0.00000				-88.437	2	4	17.F	-443.046	31018.	106.048
DEC	0.00000				-211.862	13	4	5.F	-545.656	29748.	82.714
TOTAL	1289.868				-874.111					391612.	
MAX									-614.450		106.051

D3-56

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 11:34:22 SDL RUN 1												
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG #7612 ENL MEN BARRACKS W/O DIN												
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR PROP-VAV TOPEKA, KS												
----- N U M B E R O F H O U R S -----												
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-227.763	5.454
FEB	0	672	0	0	672	0	672	0	0	0	-236.672	5.454
MAR	0	714	0	30	744	0	744	0	0	30	-264.058	5.454
APR	0	430	0	290	720	0	720	0	0	290	0.000	19.557
MAY	384	157	0	203	360	384	744	0	0	203	0.000	22.296
JUN	720	0	0	0	0	720	720	0	0	0	0.000	92.331
JUL	744	0	0	0	0	744	744	0	0	0	0.000	95.645
AUG	744	0	0	0	0	744	744	0	0	0	0.000	95.256
SEP	720	0	0	0	0	720	720	0	0	0	0.000	91.997
OCT	24	271	0	449	720	24	744	0	0	449	0.000	76.363
NOV	0	577	0	143	720	0	720	0	0	143	-331.374	5.454
DEC	0	744	0	0	744	0	744	0	0	0	-385.224	5.454
ANNUAL	3336	4309	0	1115	5424	3336	8760	0	0	1115		

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY TOTAL (MBTU) PEAK (KBTU) DY/HR	NATURAL-GAS TOTAL (MBTU) PEAK (KBTU) DY/HR
JAN	112.439 288.836 9/18	112.439 288.836 9/18	321.563 773.180 15/4
FEB	101.360 285.337 13/18	101.360 285.337 13/18	242.562 703.499 3/4
MAR	112.548 341.495 10/20	112.548 341.495 10/20	181.573 641.603 3/4
APR	125.087 362.103 29/9	125.087 362.103 29/9	49.447 422.334 5/4
MAY	169.800 566.920 31/18	169.800 566.920 31/18	12.195 233.300 5/4
JUN	213.259 571.228 19/19	213.259 571.228 19/19	0.000 0.000 30/1
JUL	242.665 611.549 23/19	242.665 611.549 23/19	0.000 0.000 31/1
AUG	244.496 613.189 21/19	244.496 613.189 21/19	0.000 0.000 31/1
SEP	180.954 580.467 6/18	180.954 580.467 6/18	0.000 0.000 30/1
OCT	128.311 391.692 1/18	128.311 391.692 1/18	32.174 405.862 20/3
NOV	112.830 362.092 24/18	112.830 362.092 24/18	135.902 588.913 2/4
DEC	112.604 288.226 21/18	112.604 288.226 21/18	299.249 700.355 13/4
	ONE YEAR USE/PEAK	1856.354 613.189	1274.666 773.180

ENERGY TYPE			
IN SITE MBTU -			
CATEGORY OF USE	ELECTRICITY	NATURAL-GAS	
SPACE HEAT	44.63	1274.67	
SPACE COOL	433.49	0.00	
HVAC AUX	254.78	0.00	
DOM HOT WTR	0.00	0.00	
AUX SOLAR	0.00	0.00	
LIGHTS	612.35	0.00	
VERT TRANS	0.00	0.00	
MISC EQUIP	511.10	0.00	
TOTAL	1856.36	1274.67	

TOTAL SITE ENERGY 3131.02 MBTU 74.8 KBTU/SQFT-YR GROSS-AREA 224.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 6849.30 MBTU 163.6 KBTU/SQFT-YR GROSS-AREA 490.7 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 25.1
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.1
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 7806 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	679.99	416.91	263.08	263.08
Annual Natural Gas (MBTU)	185.29	280.54	-95.25	-95.25
Electric Demand June (KW)	58.54	44.88	13.66	13.66
Electric Demand July (KW)	60.91	47.47	13.44	13.44
Electric Demand August (KW)	63.88	50.09	13.79	13.79

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7656 (sq.ft.)	11310
ECO Model Bldg 7806 (sq.ft.)	11310
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE: 05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 7806 - Replace SZs AHUs w/ VAV AHUs

A. CONSTRUCTION COST	=	\$31,366
B. SIOH COST	(5.5% of 1A) =	\$1,725
C. DESIGN COST	(6.0% of 1A) =	\$1,882
D. TOTAL COST	(1A + 1B + 1C) =	\$34,973
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$34,973

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	263	\$3,183	15.88	\$50,550
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(95)	(\$392)	18.30	(\$7,181)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$735	14.88	\$10,937
F. TOTAL		168	\$3,526		-----> \$54,306

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$0
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST				\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$23,323	5	0.863	\$20,128
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$23,323			\$20,128

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$20,128

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$4,692
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.45
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$74,433
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	2.13

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF	1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95		
						ESTIMATOR		C. Wohler		
						CHECKED BY		A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL	
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit		Total
1		BUILDING 7806								
2		PROPOSED SYSTEM MODIFICATIONS								
3										
4		NEW SYSTEMS INSTALLATION								
5	AHU5400	5,400 CFM AHU, COOLING ONLY	EA.	1.0	\$3,803.33	\$3,803	Q-6	30	\$603	\$4,406
6	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	1.0	\$4,433.18	\$4,433	Q-6	40	\$804	\$5,237
7	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	\$310.08	\$620	1-SHEE	1.48	\$62	\$682
8	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	2.0	\$287.31	\$575	1-SHEE	1.33	\$55	\$630
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	4.0	\$24.23	\$97	1-ELEC	0.8	\$67	\$164
10	WIRE#12	COPPER WIRING #12	C.L.F.	1.3	\$7.41	\$9	1-ELEC	0.727	\$19	\$28
11	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	60.0	\$2.95	\$177	Q-1	0.2	\$233	\$409
12		FITTINGS ADD 5%				\$9			\$12	\$20
13	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	60.0	\$1.40	\$84	Q-14	0.08	\$88	\$172
14	CNTV1	CONTROL VALVE 1"	EA.	2.0	\$190.89	\$382	1-PLUM	0.471	\$20	\$402
15	VSD3	VARIABLE SPEED DRIVE W/ CONTRLR,3HP	EA.	2.0	\$2,238.39	\$4,477	1-ELEC	10.5	\$439	\$4,916
16	REHEAT3	REHEAT COIL, 2ROW, 3x1'	EA.	2.0	\$154.07	\$308	Q-5	1.32	\$51	\$359
17	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	2.0	\$138.57	\$277	Q-5	1.32	\$51	\$328
18	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	120.0	\$2.10	\$252	Q-1	0.151	\$351	\$604
19		VALVES & FITTINGS ADD 15%				\$38			\$91	\$91
20	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	120.0	\$0.62	\$74	Q-14	0.073	\$161	\$236
21	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	300.0	\$0.47	\$140	Q-10	0.098	\$571	\$711
22										
23										
24										
25		EXISTING SYSTEMS DEMOLITION								
26		AHU DEMO	TON	2.8			Q-5	17.778	\$948	\$948
27										
28										
29										
30										
31		SUBTOTAL				\$15,755			\$4,590	\$20,344
32	OH	OVERHEAD			17%	\$2,647			\$771	\$3,418
33	PRO	PROFIT			10%	\$1,840			\$536	\$2,376
34	CONT	CONTINGENCY			20%	\$4,048			\$1,179	\$5,228
35	TOTAL COST					\$24,290			\$7,076	\$31,366

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade			SHEET 1 OF 1		DATE PREPARED 4-May-95		
ENGINEER		E M C Engineers, Inc. Denver, CO			ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7806							
2		NON-RECURRING							
3									
4		EXISTING SYSTEM REPLACEMENT							
5	AHUH5400	5,400 CFM AHU	EA.	1.0	\$4,563.99	Q-6	31.5	\$633	\$5,197
6	AHUH8000	8,000 CFM AHU	EA.	1.0	\$5,319.81	Q-6	42	\$844	\$6,164
7	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	300.0	\$0.47	Q-10	0.098	\$571	\$711
8	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	\$24.23	1-ELEC	0.8	\$33	\$82
9	WIRE#12	COPPER WIRING #12	C.L.F.	0.8	\$7.41	1-ELEC	0.727	\$11	\$17
10	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	120.0	\$2.95	Q-1	0.2	\$465	\$819
11		FITTINGS ADD 5%						\$23	\$41
12	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	\$1.40	Q-14	0.08	\$177	\$344
13	CNTV1	CONTROL VALVE 1"	EA.	4.0	\$190.89	1-PLUM	0.471	\$41	\$804
14									
15									
16									
17									
18									
19									
20									
21									
22		EXISTING SYSTEMS DEMOLITION							
23		AHU DEMO	TON	2.8		Q-5	17.778	\$948	\$948
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL			\$11,380			\$3,748	\$15,127
32	OH	OVERHEAD			17%			\$630	\$2,541
33	PRO	PROFIT			10%			\$438	\$1,767
34	CONT	CONTINGENCY			20%			\$963	\$3,887
35	TOTAL COST				\$17,544			\$5,778	\$23,323

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT										DATE PREPARED			
ENGINEER										ESTIMATOR			
										CHECKED BY			
Fort Riley Feasibility Study for HVAC Upgrade										4-May-95			
E M C Engineers, Inc.										C. Wohler			
Denver, CO										A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL				
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total				
1		BUILDING 7806											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE				\$0			\$0				
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE				\$0			\$0				
30													
31													
32													
33													
34													
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS				\$0			\$0				

DEMAND LIMITING ANALYSIS BUILDING 7806

SUMMER PEAK (KW) = 27812	1993												1993	
	JUL BILL 7/1-8/2 ACTUAL	AUG BILL 8/2-9/1 ACTUAL	SEP BILL 9/3-10/1 ACTUAL	OCT BILL 10/1-11/1 ACTUAL	NOV BILL 11/1-12/1 ACTUAL	DEC BILL 12/1-1/3 ACTUAL	JAN BILL 1/4-2/1 ACTUAL	FEB BILL 2/1-3/1 ACTUAL	MAR BILL 3/3-4/1 ACTUAL	APR BILL 4/1-5/3 ACTUAL	MAY BILL 5/3-6/1 ACTUAL	JUN BILL 6/1-7/1 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE														
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23	\$110,208.22	\$120,939.23
SUB DISCOUNT @ \$20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46	\$212,740.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42	\$469,215.45	\$543,973.42
DEMAND REDUCTION (KW)	13.44	13.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.66	0.00	13.66
CAPACITY (KW)	32459	34438	26136	20754	26400	22752	27108	25812	23310	21834	21996	30082	21996	30082
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%	99.60%	98.80%
CAPACITY (KVA)	32720	34751	26373	20775	26453	22820	27244	25916	23404	21878	22084	30448	22084	30448
80% SUMMER PEAK (KVA)	27801	27801	27801	27801	27801	27801	27801	27801	27801	27801	27801	27801	27801	27801
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32720	34751	27801	27801	27801	27801	27801	27801	27801	27801	27801	30448	27801	30448
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,087.29	\$138,311.44	\$110,163.15	\$110,163.15	\$110,163.15	\$110,163.15	\$110,163.15	\$110,163.15	\$110,163.15	\$110,163.15	\$110,163.15	\$120,883.25	\$110,163.15	\$120,883.25
SUB DISCOUNT @ \$20	(\$6,544.06)	(\$6,950.19)	(\$5,560.16)	(\$5,560.16)	(\$5,560.16)	(\$5,560.16)	(\$5,560.16)	(\$5,560.16)	(\$5,560.16)	(\$5,560.16)	(\$5,560.16)	(\$6,089.54)	(\$5,560.16)	(\$6,089.54)
CAPACITY CHARGE	\$126,133.22	\$133,951.24	\$107,192.99	\$107,192.99	\$107,192.99	\$107,192.99	\$107,192.99	\$107,192.99	\$107,192.99	\$107,192.99	\$107,192.99	\$117,383.70	\$107,192.99	\$117,383.70
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,197.26	\$68,181.41	\$54,545.13	\$54,545.13	\$54,545.13	\$54,545.13	\$54,545.13	\$54,545.13	\$54,545.13	\$54,545.13	\$54,545.13	\$59,738.42	\$54,545.13	\$59,738.42
100*KVA @ \$.03404	\$111,379.96	\$118,292.31	\$94,633.85	\$94,633.85	\$94,633.85	\$94,633.85	\$94,633.85	\$94,633.85	\$94,633.85	\$94,633.85	\$94,633.85	\$103,644.02	\$94,633.85	\$103,644.02
250*KVA @ \$.03084	\$252,273.65	\$267,929.99	\$210,016.80	\$184,111.20	\$214,343.99	\$214,343.99	\$214,343.99	\$214,343.99	\$214,343.99	\$212,792.40	\$171,158.40	\$234,751.89	\$212,792.40	\$234,751.89
EXCESS @ \$.02864	\$109,744.84	\$65,860.87	\$0.00	\$0.00	\$1,136.69	\$51,829.49	\$42,378.29	\$32,927.09	\$38,941.49	\$0.00	\$0.00	\$28,379.77	\$0.00	\$28,379.77
ENERGY CHARGE	\$537,595.72	\$520,264.57	\$359,195.78	\$333,290.18	\$364,659.66	\$415,352.46	\$405,901.26	\$396,450.06	\$402,464.46	\$361,971.38	\$320,337.38	\$426,514.10	\$320,337.38	\$426,514.10
TOTAL CHARGE LESS ECA	\$663,728.94	\$654,215.82	\$466,388.77	\$440,483.17	\$471,852.65	\$522,545.45	\$513,094.25	\$503,643.05	\$509,657.45	\$469,164.37	\$427,530.37	\$543,897.80	\$469,164.37	\$543,897.80
SUMMARY														
MONTHLY DIFFERENCE	\$74.13	\$76.10	\$51.09	\$51.09	\$60.88	\$60.88	\$60.88	\$60.88	\$60.88	\$51.09	\$51.09	\$75.61	\$51.09	\$75.61
ANNUAL DIFFERENCE														

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 18 RECTANGULAR 18 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	G L A S S U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	W A L L U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	W A L L + G L A S S U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
E-PER_ZONE		0.000		0.00	0.092	0.092	156.00	0.092	0.092	156.00	NORTH
N-PER_ZONE		0.490		16.00	0.092	0.092	686.00	0.101	0.101	702.00	NORTH
N-PER_ZONE		0.490		576.00	0.092	0.092	432.00	0.320	0.320	1008.00	NORTH
E-PER_ZONE		0.490		192.00	0.092	0.092	843.60	0.166	0.166	1035.60	EAST
S-PER_ZONE		0.490		576.00	0.092	0.092	432.00	0.320	0.320	1008.00	SOUTH
S-PER_ZONE		0.490		42.40	0.092	0.092	659.60	0.116	0.116	702.00	SOUTH
E-PER_ZONE		0.000		0.00	0.092	0.092	156.00	0.092	0.092	156.00	SOUTH
W-PER_ZONE		0.490		115.20	0.092	0.092	1438.20	0.122	0.122	1553.40	WEST
W-PER_ZONE		0.000		0.00	0.036	0.036	1069.50	0.036	0.036	1069.50	ROOF
E-PER_ZONE		0.000		0.00	0.040	0.040	1763.00	0.040	0.040	1763.00	ROOF
CORE_ZONE		0.000		0.00	0.036	0.036	338.40	0.036	0.036	338.40	ROOF
CORE_ZONE		0.000		0.00	0.040	0.040	972.90	0.040	0.040	972.90	ROOF
S-PER_ZONE		0.000		0.00	0.040	0.040	1147.50	0.040	0.040	1147.50	ROOF
S-PER_ZONE		0.000		0.00	0.036	0.036	472.50	0.036	0.036	472.50	ROOF
N-PER_ZONE		0.000		0.00	0.036	0.036	472.50	0.036	0.036	472.50	ROOF
N-PER_ZONE		0.000		0.00	0.040	0.040	1147.50	0.040	0.040	1147.50	ROOF
CORE_ZONE		0.000		0.00	0.036	0.036	338.40	0.036	0.036	338.40	ROOF
CORE_ZONE		0.000		0.00	0.040	0.040	972.90	0.040	0.040	972.90	ROOF
S-PER_ZONE		0.000		0.00	0.020	0.020	1620.00	0.020	0.020	1620.00	UNDERGRND
W-PER_ZONE		0.000		0.00	0.020	0.020	1069.50	0.020	0.020	1069.50	UNDERGRND
E-PER_ZONE		0.000		0.00	0.020	0.020	1763.00	0.020	0.020	1763.00	UNDERGRND
CORE_ZONE		0.000		0.00	0.020	0.020	1311.30	0.020	0.020	1311.30	UNDERGRND
N-PER_ZONE		0.000		0.00	0.020	0.020	1620.00	0.020	0.020	1620.00	UNDERGRND

D4-7

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	G L A S S U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	W A L L U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	W A L L + G L A S S U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
CORE_ZONE		0.000		0.00	0.020	0.020	1311.30	0.020	0.020	1311.30	UNDERGRND

EMC ENGINEERS INC.		EZDOE - ELITE SOFTWARE DEVELOPMENT INC		DOE-2.1D 2/28/1995		16:42:42 LDL RUN 1	
DENVER, CO 80227		EXISTING CONDITION OF BLDG. 7806		BATTALIAN HQ BLDG			
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT				TOPEKA, KS			
	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)	
NORTH	0.490	0.092	0.218	592.00	1274.00	1866.00	
EAST	0.490	0.092	0.166	192.00	843.60	1035.60	
SOUTH	0.490	0.092	0.224	618.40	1247.60	1866.00	
WEST	0.490	0.092	0.122	115.20	1438.20	1553.40	
ROOF	0.000	0.039	0.039	0.00	8695.10	8695.10	
ALL WALLS	0.490	0.092	0.188	1517.60	4803.40	6321.00	
WALLS+ROOFS	0.490	0.058	0.102	1517.60	13498.50	15016.10	
UNDERGRND	0.000	0.020	0.020	0.00	8695.10	8695.10	
BUILDING	0.490	0.043	0.072	1517.60	22193.60	23711.20	

*** BUILDING ***

FLOOR AREA 11308 SQFT 1051 SQMT
VOLUME 155888 CUFT 4415 CUMT

TIME	COOLING LOAD		HEATING LOAD	
	SEP 6	4PM	JAN 4	3AM
DRY-BULB TEMP	93F	34C	8F	-13C
WET-BULB TEMP	76F	24C	7F	-14C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	3.442	1.008	0.000	0.000	-21.795	-6.383
ROOFS	7.640	2.237	0.000	0.000	-20.670	-6.054
GLASS CONDUCTION	16.171	4.736	0.000	0.000	-51.796	-15.170
GLASS SOLAR	64.340	18.844	0.000	0.000	2.180	0.639
DOOR	0.703	0.206	0.000	0.000	-1.970	-0.577
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.760	-0.223	0.000	0.000	-4.993	-1.462
OCCUPANTS TO SPACE	13.533	3.963	25.700	7.527	1.497	0.439
LIGHT TO SPACE	41.317	12.101	0.000	0.000	8.720	2.554
EQUIPMENT TO SPACE	8.708	2.550	0.000	0.000	1.215	0.356
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	47.491	13.909	72.640	21.275	-157.561	-46.146
TOTAL	202.585	59.332	98.340	28.801	-245.173	-71.805
TOTAL LOAD	300.925	KBTU/H	88.133	KW	-245.173	KW
TOTAL LOAD / AREA	26.61	BTU/H.SQFT	83.894	W /SQMT	21.682	BTU/H.SQFT W /SQMT

*
* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR
*
* LOADS
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION
*
* IN CONSIDERATION
*

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 SDL RUN 1											
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR N_SZ_SYSTM TOPEKA, KS											
----- C O O L I N G ----- H E A T I N G ----- E L E C -----											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-23.548	4 3	8.F	7.F	-87.836	5987.	12.950
FEB	0.00000				-15.055	1 23	17.F	15.F	-66.839	5411.	12.950
MAR	0.00000				-8.787	3 4	16.F	13.F	-67.103	6203.	12.950
APR	0.00000				-1.117	4 6	32.F	31.F	-30.839	5867.	12.950
MAY	19.99711	16 2	62.F	59.F	-0.257	3 22	58.F	56.F	-7.037	5987.	12.950
JUN	41.56113	21 16	88.F	74.F	0.000				0.000	5975.	12.950
JUL	46.98882	1 16	86.F	80.F	0.000				0.000	5879.	12.950
AUG	47.26728	24 19	92.F	76.F	0.000				0.000	6203.	12.950
SEP	30.63215	6 16	93.F	76.F	0.000				0.000	5867.	12.950
OCT	0.42061	1 17	85.F	68.F	-0.869	31 7	43.F	39.F	-31.089	5879.	12.950
NOV	0.00000				-5.784	28 6	26.F	24.F	-40.961	5759.	12.950
DEC	0.00000				-20.068	11 24	10.F	9.F	-74.184	5987.	12.950
TOTAL	186.867				-75.484				-87.836	71002.	12.950
MAX											

D4-1

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 SDL RUN 1										
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG										
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR N_SZ_SYSTM TOPEKA, KS										
----- N U M B E R O F H O U R S -----										
	HOURS			HOURS			HOURS			
	COOLING	HEATING	COINCIDENT	HEATING	COOLING	FANS ON	NIGHT	FLOATING	COINCIDENT LOADS--	
MONTH	LOAD	LOAD	LOAD	AVAIL.	AVAIL.	CYCLE ON	VENTING	WHEN	HEATING	
								FANS ON	LOAD AT	
									COOLING	
									PEAK	
									(KW)	
JAN	0	716	0	744	0	0	0	28	-22.297	5.072
FEB	0	638	0	672	0	0	0	34	-19.505	5.072
MAR	0	557	0	744	0	0	0	187	-15.554	5.072
APR	0	365	0	720	0	0	0	355	-1.901	4.992
MAY	384	163	0	360	384	0	0	197	0.000	5.072
JUN	720	0	0	0	720	0	0	0	0.000	12.950
JUL	744	0	0	744	744	0	0	0	0.000	12.950
AUG	744	0	0	744	744	0	0	0	0.000	12.950
SEP	657	0	0	0	657	0	0	63	0.000	12.950
OCT	14	352	0	720	14	0	0	378	0.000	4.992
NOV	0	517	0	720	0	0	0	203	-25.679	5.072
DEC	0	706	0	744	0	0	0	38	-34.098	4.992
ANNUAL	3263	4014	0	5424	3263	8760	0	1483		

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR S_SZ_SYSTEM TOPEKA, KS

MONTH	COOLING				MAXIMUM COOLING LOAD (KBTU/HR)	HEATING				H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP							
JAN	0.00000				0.000	-13.875	4 3	8. F	7. F	-80.337	6400.	14.145				
FEB	0.00000				0.000	-7.130	2 4	10. F	9. F	-57.465	5784.	14.145				
MAR	0.00000				0.000	-4.570	3 4	16. F	13. F	-59.035	6644.	14.145				
APR	0.00000				0.000	-0.744	5 6	31. F	28. F	-19.872	6276.	14.145				
MAY	22.75988	16 2	62. F	59. F	228.613	-0.315	3 22	58. F	56. F	-7.249	6400.	14.145				
JUN	45.82773	21 16	88. F	74. F	135.044	0.000				0.000	6398.	14.145				
JUL	52.00711	1 16	86. F	80. F	149.645	0.000				0.000	6277.	14.145				
AUG	54.94657	24 16	96. F	77. F	165.374	0.000				0.000	6644.	14.145				
SEP	40.82925	6 16	93. F	76. F	170.048	0.000				0.000	6276.	14.145				
OCT	1.01801	1 16	83. F	67. F	108.812	-0.919	2 5	55. F	53. F	-11.556	6277.	14.145				
NOV	0.00000				0.000	-1.618	2 6	15. F	14. F	-37.692	6154.	14.145				
DEC	0.00000				0.000	-12.638	11 24	10. F	9. F	-68.590	6400.	14.145				
TOTAL	217.389					-41.809					75932.					
MAX					228.613					-80.337		14.145				

D4-11

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR S_SZ_SYSTEM TOPEKA, KS

MONTH	HOURS COOLING		HOURS COINCIDENT COOL-HEAT LOAD		HOURS HEATING		HOURS COOLING		HOURS FANS ON		HOURS NIGHT VENTING		HOURS FLOATING WHEN FANS ON		--COINCIDENT LOADS--	
	LOAD	HEATING LOAD	LOAD	HEATING LOAD	HEATING AVAIL.	COOLING AVAIL.	FANS ON	COOLING	FANS ON	CYCLE ON	NIGHT VENTING	WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		
JAN	0	661	0	83	744	0	744	0	0	0	0	83	-3.886	5.238		
FEB	0	536	0	136	672	0	672	0	0	0	0	136	-2.896	5.238		
MAR	0	500	0	244	744	0	744	0	0	0	0	244	-2.751	5.238		
APR	0	384	0	336	720	0	720	0	0	0	0	336	-2.345	5.148		
MAY	384	172	0	188	360	384	744	0	0	0	0	188	0.000	5.238		
JUN	720	0	0	0	0	720	720	0	0	0	0	0	0.000	14.145		
JUL	744	0	0	0	0	744	744	0	0	0	0	0	0.000	14.145		
AUG	744	0	0	0	0	744	744	0	0	0	0	0	0.000	14.145		
SEP	686	0	34	34	0	686	720	0	0	0	0	34	0.000	14.145		
OCT	15	409	0	320	720	15	744	0	0	0	0	320	0.000	5.148		
NOV	0	480	0	240	720	0	720	0	0	0	0	240	-0.895	5.238		
DEC	0	630	0	114	744	0	744	0	0	0	0	114	-37.222	5.148		
ANNUAL	3293	3772	0	1695	5424	3293	8760	0	0	0	0	1695				

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 44.608 96.556 28/12	NATURAL-GAS 55.844 211.968 4/ 3
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	40.039 96.556 22/ 9	35.543 163.289 2/ 3
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	45.021 96.556 31/ 9	21.714 166.900 3/ 4
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	41.801 95.241 5/ 8	3.964 77.213 5/ 6
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	60.036 199.006 16/16	1.335 25.635 3/22
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	78.518 199.792 21/16	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	82.136 207.894 22/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	87.141 218.010 24/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	72.172 215.554 6/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	42.501 96.629 1/17	3.891 68.444 31/ 7
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	41.544 96.556 2/ 8	13.248 113.371 2/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	44.477 96.556 30/20	49.755 184.983 11/24
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	679.995 218.010	185.295 211.968

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	7.83	185.29
SPACE COOL	152.42	0.00
HVAC AUX	321.36	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	165.33	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	33.06	0.00
TOTAL	679.99	185.29

TOTAL SITE ENERGY 865.29 MBTU 76.5 KBTU/SQFT-YR GROSS-AREA 76.5 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 2227.32 MBTU 196.9 KBTU/SQFT-YR GROSS-AREA 197.0 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 9.3
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC												DOE-2.1D		2/22/1995		14:14:48		SDL RUN 1							
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7806												BATTALIAN HQ BLDG													
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR												N_VAV_SYST		TOPEKA, KS											
												H E A T I N G				E L E C									
												HEATING ENERGY (MBTU)		TIME OF MAX DY HR		DRY- BULB TEMP		WET- BULB TEMP		MAXIMUM HEATING LOAD (KBTU/HR)		ELEC- TRICAL ENERGY (KWH)		MAXIMUM ELEC LOAD (KW)	
MONTH	COOLING ENERGY (MBTU)	TIME OF DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)													
JAN	0.00000				0.000	-28.434	15	-6.F	-7.F	-68.764	2543.	10.739													
FEB	0.00000				0.000	-20.152	3	-1.F	-2.F	-63.647	2347.	13.550													
MAR	0.00000				0.000	-13.026	14	15.F	13.F	-52.349	3319.	14.927													
APR	0.00000				0.000	-3.299	5	31.F	28.F	-32.519	4052.	14.927													
MAY	13.08116	16	2	62.F	59.F	-0.860	11	52.F	51.F	-11.611	3650.	14.927													
JUN	27.83931	29	19	87.F	74.F	0.000				0.000	2784.	10.019													
JUL	32.33242	22	19	92.F	78.F	0.000				0.000	2620.	10.261													
AUG	32.08073	24	18	93.F	76.F	0.000				0.000	2952.	10.186													
SEP	19.81511	8	18	89.F	72.F	0.000				0.000	2571.	9.711													
OCT	0.37803	1	17	85.F	68.F	-3.357	2	64.F	59.F	-58.889	3501.	14.927													
NOV	0.00000				0.000	-12.374	3	13.F	12.F	-50.130	2906.	14.927													
DEC	0.00000				0.000	-24.852	12	3.F	2.F	-62.740	2605.	9.841													
TOTAL	125.527					-106.354					35850.														
MAX					140.967					-68.764		14.927													

D
11
4

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC										DOE-2.1D 2/22/1995 14:14:48 SDL RUN 1									
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7806										BATTALIAN HQ BLDG									
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR										TOPEKA, KS									
N_VAV_SYST																			
H O U R S										--COINCIDENT LOADS--									
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS ON	HOURS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)						
JAN	0	743	0	1	744	0	744	0	0	0	1	-33.635	0.400						
FEB	0	667	0	5	672	0	672	0	0	0	5	-32.198	0.400						
MAR	0	646	0	98	744	0	744	0	0	0	98	-22.976	0.778						
APR	0	436	0	284	720	0	720	0	0	0	284	-7.931	1.211						
MAY	384	163	0	197	360	384	744	0	0	0	197	0.000	3.921						
JUN	720	0	0	0	720	720	744	0	0	0	0	0.000	10.019						
JUL	744	0	0	0	744	744	744	0	0	0	0	0.000	10.261						
AUG	744	0	0	0	744	744	744	0	0	0	0	0.000	10.157						
SEP	720	0	0	0	720	720	744	0	0	0	0	0.000	9.711						
OCT	24	385	0	335	720	24	744	0	0	0	335	0.000	0.321						
NOV	0	601	0	119	720	0	720	0	0	0	119	-36.602	0.457						
DEC	0	741	0	3	744	0	744	0	0	0	3	-46.252	0.321						
ANNUAL	3336	4382	0	1042	5424	3336	8760	0	0	0	1042								

EMC ENGINEERS INC. 80227 INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:14:48 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR S_VAV_SYST TOPEKA, KS

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP			
JAN	0.00000				0.000	15	-6.F	-7.F	-82.394	3395.	14.042	
FEB	0.00000				0.000	3	-5.F	-6.F	-68.710	3320.	15.423	
MAR	0.00000				0.000	14	15.F	13.F	-57.256	4641.	16.184	
APR	0.00000				0.000	5	31.F	28.F	-33.735	5290.	16.184	
MAY	16.16931	16	62.F	59.F	148.838	11	52.F	51.F	-18.813	4292.	16.184	
JUN	35.24581	29	89.F	75.F	122.405				0.000	3288.	12.130	
JUL	41.42882	13	93.F	77.F	131.518				0.000	3118.	12.480	
AUG	44.38872	23	96.F	77.F	146.479				0.000	3650.	13.531	
SEP	29.63825	7	93.F	76.F	148.987				0.000	3191.	13.908	
OCT	0.56560	1	85.F	68.F	55.012	31	44.F	39.F	-27.618	5356.	16.184	
NOV	0.00000				0.000	2	15.F	14.F	-54.092	4542.	16.184	
DEC	0.00000				0.000	12	3.F	2.F	-74.566	3660.	14.511	
TOTAL	167.437				-81.311				-82.394	47744.	16.184	
TAX					148.987							

D4-15

EMC ENGINEERS INC. 80227 INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:14:48 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR S_VAV_SYST TOPEKA, KS

MONTH	N U M B E R O F H O U R S										COINCIDENT LOADS		
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING LOAD	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	
JAN	0	713	0	31	744	0	744	0	0	31	-10.892	2.920	
FEB	0	628	0	44	672	0	672	0	0	44	-9.101	3.690	
MAR	0	449	0	295	744	0	744	0	0	295	-11.307	3.185	
APR	0	245	0	475	720	0	720	0	0	475	0.000	7.187	
MAY	384	159	0	201	744	384	744	0	0	201	0.000	3.674	
JUN	720	0	0	0	720	720	720	0	0	0	0.000	12.130	
JUL	744	0	0	0	744	744	744	0	0	0	0.000	12.480	
AUG	744	0	0	0	744	744	744	0	0	0	0.000	13.531	
SEP	720	0	0	0	720	720	720	0	0	0	0.000	13.908	
OCT	24	113	0	607	744	24	744	0	0	607	0.000	0.949	
NOV	0	414	0	306	720	0	720	0	0	306	-21.906	1.136	
DEC	0	679	0	65	744	0	744	0	0	65	-50.341	0.331	
ANNUAL	3336	3400	0	2024	3336	5424	8760	0	0	2024			

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 22.822 80.648 12/14	NATURAL-GAS 74.066 190.522 15/ 8
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	21.493 88.853 25/19	53.561 169.770 3/ 6
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	28.769 98.014 10/19	34.735 145.869 14/ 6
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	32.565 106.225 26/13	9.851 96.888 5/ 6
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	39.394 162.242 16/16	3.937 51.775 11/ 3
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	46.266 153.180 29/16	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.936 162.008 22/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	53.696 170.955 11/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	40.961 163.793 7/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	31.271 98.014 12/ 8	8.038 113.910 2/ 2
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	26.915 98.014 17/20	29.949 137.335 2/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.829 82.182 23/11	66.398 175.886 12/ 6
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	416.915 170.955	280.536 190.522

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	10.38	280.54
SPACE COOL	109.06	0.00
HVAC AUX	99.07	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	165.33	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	33.07	0.00
TOTAL	416.91	280.54

TOTAL SITE ENERGY 697.45 MBTU 61.6 KBTU/SQFT-YR GROSS-AREA 61.7 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1532.53 MBTU 135.5 KBTU/SQFT-YR GROSS-AREA 135.5 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 55.7
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.



BUILDING 8025 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	279.74	210.23	69.51	65.38
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	49.28	51.48	-2.19	-2.06
Electric Demand July (KW)	50.66	52.89	-2.22	-2.09
Electric Demand August (KW)	51.18	53.42	-2.24	-2.11

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7108 (sq.ft.)	12180
ECO Model Bldg 8025 (sq.ft.)	11456
Square Footage Adjustment Factor	0.941

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE: 05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 8025 - Convert (3) Existing MZs to VAV AHUs

A. CONSTRUCTION COST	=	\$15,500
B. SIOH COST	(5.5% of 1A) =	\$852
C. DESIGN COST	(6.0% of 1A) =	\$930
D. TOTAL COST	(1A + 1B + 1C) =	\$17,282
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$17,282

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	65	\$791	15.88	\$12,563
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	0	\$0	18.30	\$0
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			(\$112)	14.88	(\$1,667)
F. TOTAL		65	\$679		-----> \$10,896

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-)	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0
b.				\$0
c.				\$0
d. TOTAL	\$0			\$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = \$0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bd1/Economic Life)) \$679

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 25.45

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$10,896

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 0.63

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 8025							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5		BLANK OFF HOT DECK	EA.	1.0	\$50.00	\$50	1-CLAB	3	\$43
6	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	3.0	\$2,238.39	\$6,715	1-ELEC	10.5	\$659
7	VAVCNTL2	VAV BOX CONTROLLER & ACTUATOR, ELEC	EA.	11.0	\$155.04	\$1,705	1-ELEC	0.33	\$76
8	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT. 3 WIRE	EA.	11.0	\$24.23	\$266	1-ELEC	0.8	\$184
9	WIRE#12	COPPER WIRING #12	C.L.F.	5.5	\$7.41	\$41	1-ELEC	0.727	\$84
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23		EXISTING SYSTEMS DEMOLITION							
24		ZONE DUCTWORK DEMOLITION	EA.	11.0			1-SHEE	1	\$229
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$8,778			\$1,275
32	OH	OVERHEAD			17%	\$1,475			\$214
33	PRO	PROFIT			10%	\$1,025			\$149
34	CONT	CONTINGENCY			20%	\$2,256			\$328
35		TOTAL COST				\$13,533			\$1,966
									\$10,053
									\$1,689
									\$1,174
									\$2,583
									\$15,500

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET 1 OF 1		DATE PREPARED 4-May-95		ESTIMATOR C. Wohler	
ENGINEER		E M C Engineers, Inc. Denver, CO		CHECKED BY A. Niemeyer					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST		TOTAL	
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 8025							
2		NON-RECURRING							
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$0			\$0
32	OH	OVERHEAD			17%	\$0			\$0
33	PRO	PROFIT			10%	\$0			\$0
34	CONT	CONTINGENCY			20%	\$0			\$0
35		TOTAL COST				\$0			\$0

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED		4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR		C. Wohler	
										CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL			
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total				
1		BUILDING 8025											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE				\$0						\$0	\$0
16													
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE				\$0						\$0	\$0
30													
31													
32													
33													
34													
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS				\$0						\$0	\$0

DEMAND LIMITING ANALYSIS BUILDING 8025

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT @ 20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	(2.09)	(2.11)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(2.06)
CAPACITY (KW)	32474	34454	26136	20754	26400	22752	27108	25812	23310	21834	21996	30098
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32736	34767	26373	20775	26453	22820	27244	25916	23404	21878	22084	30464
80% SUMMER PEAK (KVA)	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32736	34767	27814	27814	27814	27814	27814	27814	27814	27814	27814	30464
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,150.72	\$138,376.39	\$110,215.11	\$110,215.11	\$110,215.11	\$110,215.11	\$110,215.11	\$110,215.11	\$110,215.11	\$110,215.11	\$110,215.11	\$120,947.69
SUB DISCOUNT @ 20	(\$6,547.20)	(\$6,953.40)	(\$5,562.72)	(\$5,562.72)	(\$5,562.72)	(\$5,562.72)	(\$5,562.72)	(\$5,562.72)	(\$5,562.72)	(\$5,562.72)	(\$5,562.72)	(\$6,092.73)
CAPACITY CHARGE	\$126,193.52	\$134,012.99	\$107,242.39	\$107,242.39	\$107,242.39	\$107,242.39	\$107,242.39	\$107,242.39	\$107,242.39	\$107,242.39	\$107,242.39	\$117,444.96
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,227.99	\$68,212.87	\$54,570.30	\$54,570.30	\$54,570.30	\$54,570.30	\$54,570.30	\$54,570.30	\$54,570.30	\$54,570.30	\$54,570.30	\$59,769.63
100*KVA @ \$.03404	\$111,433.28	\$118,346.90	\$94,677.52	\$94,677.52	\$94,677.52	\$94,677.52	\$94,677.52	\$94,677.52	\$94,677.52	\$94,677.52	\$94,677.52	\$103,698.18
250*KVA @ \$.03084	\$252,394.41	\$268,053.64	\$209,957.45	\$184,051.85	\$214,442.92	\$214,442.92	\$214,442.92	\$214,442.92	\$214,442.92	\$212,733.05	\$171,099.05	\$234,874.56
EXCESS @ \$.02864	\$109,565.41	\$65,677.14	\$0.00	\$0.00	\$989.71	\$51,682.51	\$42,231.31	\$32,780.11	\$38,794.51	\$0.00	\$0.00	\$28,197.50
ENERGY CHARGE	\$537,621.09	\$520,290.56	\$359,205.27	\$333,299.67	\$364,680.44	\$415,373.24	\$405,922.04	\$396,470.84	\$402,485.24	\$361,980.87	\$320,346.87	\$426,539.87
TOTAL CHARGE LESS ECA	\$663,814.61	\$654,303.54	\$466,447.66	\$440,542.06	\$471,922.83	\$522,615.63	\$513,164.43	\$503,713.23	\$509,727.63	\$469,223.26	\$427,589.26	\$543,984.83
SUMMARY												
MONTHLY DIFFERENCE	(\$11.54)	(\$11.63)	(\$7.81)	(\$7.81)	(\$9.30)	(\$9.30)	(\$9.30)	(\$9.30)	(\$9.30)	(\$7.81)	(\$7.81)	(\$11.42)
ANNUAL DIFFERENCE.....		(\$112)										

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 5/ 2/1995 9:49:43 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 8025 BN ADMIN & CLRM TOPEKA, KS
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

NUMBER OF EXTERIOR SURFACES 13 RECTANGULAR 13 OTHER 0
 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALLS+GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	GLASS+OPAQUE AREA (SQFT)	AZIMUTH
	SPACE_1	0.000	0.00	0.065	0.065	294.50	0.065	294.50	NORTH
	SPACE_3	0.000	0.00	0.065	0.065	558.00	0.065	558.00	NORTH
	SPACE_4	0.000	0.00	0.065	0.065	341.00	0.065	341.00	NORTH
	SPACE_1	0.490	133.65	0.103	0.103	1834.85	0.129	1968.50	EAST
	SPACE_4	0.000	0.00	0.103	0.103	651.00	0.103	651.00	EAST
	SPACE_2	0.000	0.00	0.065	0.065	651.00	0.065	651.00	SOUTH
	SPACE_1	0.000	0.00	0.065	0.065	558.00	0.065	558.00	SOUTH
	SPACE_3	0.490	29.70	0.103	0.103	1380.80	0.111	1410.50	WEST
	SPACE_2	0.490	74.25	0.103	0.103	1119.25	0.127	1193.50	WEST
	SPACE_3	0.000	0.00	0.128	0.128	3570.00	0.128	3570.00	ROOF
	SPACE_1	0.000	0.00	0.128	0.128	4445.00	0.128	4445.00	ROOF
	SPACE_2	0.000	0.00	0.128	0.128	3234.00	0.128	3234.00	ROOF
	SPACE_4	0.000	0.00	0.128	0.128	924.00	0.128	924.00	ROOF
	SPACE_1	0.000	0.00	0.020	0.020	4445.00	0.020	4445.00	UNDERGRND
	SPACE_2	0.000	0.00	0.020	0.020	3234.00	0.020	3234.00	UNDERGRND
	SPACE_3	0.000	0.00	0.020	0.020	3570.00	0.020	3570.00	UNDERGRND
	SPACE_4	0.000	0.00	0.020	0.020	924.00	0.020	924.00	UNDERGRND

D4-25

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 5/ 2/1995 9:49:43 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 8025 BN ADMIN & CLRM TOPEKA, KS
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.000	0.065	0.065	0.00	1193.50	1193.50
EAST	0.490	0.103	0.123	133.65	2485.85	2619.50
SOUTH	0.000	0.065	0.065	0.00	1209.00	1209.00
WEST	0.490	0.103	0.119	103.95	2500.05	2604.00
ROOF	0.000	0.128	0.128	0.00	12173.00	12173.00
ALL WALLS	0.490	0.091	0.103	237.60	7388.40	7626.00
WALLS+ROOFS	0.490	0.114	0.118	237.60	19561.40	19799.00
UNDERGRND	0.000	0.020	0.020	0.00	12173.00	12173.00
BUILDING	0.490	0.078	0.081	237.60	31734.40	31972.00

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 5/ 2/1995 9:49:43 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 8025 BN ADMIN & CLRM
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 12179 SQFT 1131 SQMT
VOLUME 188775 CUFT 5346 CUMT

TIME DRY-BULB TEMP WET-BULB TEMP
AUG 4 5PM 33C 21C
COOLING LOAD
HEATING LOAD
OCT 1 8AM 47F 8C
45F 7C

	SENSIBLE (KBTU/H) (KW)		LATENT (KBTU/H) (KW)		SENSIBLE (KBTU/H) (KW)	
WALLS	1.434	0.420	0.000	0.000	-15.936	-4.667
ROOFS	121.717	35.648	0.000	0.000	-47.801	-14.000
GLASS CONDUCTION	1.035	0.303	0.000	0.000	-3.517	-1.030
GLASS SOLAR	6.967	2.041	0.000	0.000	0.665	0.195
DOOR	2.359	0.691	0.000	0.000	-2.633	-0.771
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.152	-0.337	0.000	0.000	-1.788	-0.524
OCCUPANTS TO SPACE	14.102	4.130	25.373	7.431	0.656	0.192
LIGHT TO SPACE	52.554	15.392	0.000	0.000	3.796	1.112
EQUIPMENT TO SPACE	8.974	2.628	0.000	0.000	0.426	0.125
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	1.274	0.373	0.595	0.174	-6.949	-2.035
TOTAL	209.264	61.288	25.968	7.605	-73.082	-21.404
TOTAL LOAD	235.231	KBTU/H	68.893	KW	-73.082 KBTU/H	-21.404
TOTAL LOAD / AREA	19.31BTU/H.SQFT		60.889	W /SQMT	6.001BTU/H.SQFT	18.917

*
* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR
*
* LOADS
*
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION
*
* IN CONSIDERATION
*

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 5/ 2/1995 9:49:43 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 8025 BN ADMIN & CLRM
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-FAN-SYS TOPEKA, KS

C O O L I N G				H E A T I N G				E L E C			
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	29.14229	31 18	90.F	76.F	0.000				0.000	5519.	26.603
JUN	75.11527	28 18	89.F	76.F	0.000				0.000	10378.	26.603
JUL	93.14638	1 16	86.F	80.F	0.000				0.000	10050.	26.603
AUG	94.40635	24 17	95.F	77.F	0.000				0.000	10790.	26.603
SEP	48.48895	6 16	93.F	76.F	0.000				0.000	10132.	26.603
OCT	0.08540	1 18	83.F	68.F	0.000				0.000	165.	6.882
TOTAL	340.385				0.000				0.000	47035.	26.603
MAX											

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 5/ 2/1995 9:49:43 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 8025 BN ADMIN & CLRM
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-FAN-SYS TOPEKA, KS

MONTH	H O U R S				H O U R S				H O U R S				C O I N C I D E N T				C O I N C I D E N T			
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	353	0	0	55	0	384	408	0	0	0.000	26.603	0.000	0.000	26.603	0.000	0.000	0.000	0.000	26.603	0.000
JUN	693	0	0	27	0	720	720	0	0	0.000	26.603	0.000	0.000	26.603	0.000	0.000	0.000	0.000	26.603	0.000
JUL	744	0	0	0	0	744	744	0	0	0.000	26.603	0.000	0.000	26.603	0.000	0.000	0.000	0.000	26.603	0.000
AUG	744	0	0	0	0	744	744	0	0	0.000	26.603	0.000	0.000	26.603	0.000	0.000	0.000	0.000	26.603	0.000
SEP	548	0	0	172	0	720	720	0	0	0.000	26.603	0.000	0.000	26.603	0.000	0.000	0.000	0.000	26.603	0.000
OCT	6	0	0	18	0	24	24	0	0	0.000	6.882	0.000	0.000	6.882	0.000	0.000	0.000	0.000	6.882	0.000
ANNUAL	3088	0	0	272	0	3336	3360	0	0	0.000	26.603	0.000	0.000	26.603	0.000	0.000	0.000	0.000	26.603	0.000

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY TOTAL (MBTU) PEAK (KBTU) DY/HR	NATURAL-GAS TOTAL (MBTU) PEAK (KBTU) DY/HR
MAY		29.231 167.446 31/18	0.000 0.000 31/ 1
JUN		61.398 168.204 28/17	0.000 0.000 30/ 1
JUL		66.355 172.908 22/18	0.000 0.000 31/ 1
AUG		70.188 174.663 23/16	0.000 0.000 31/ 1
SEP		51.944 170.663 6/16	0.000 0.000 30/ 1
OCT		0.627 40.146 1/18	0.000 0.000 1/ 1
	ONE YEAR USE/PEAK	279.742 174.663	0.000 0.000

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.00	0.00
SPACE COOL	114.55	0.00
HVAC AUX	83.55	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	70.06	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	11.59	0.00
TOTAL	279.74	0.00

TOTAL SITE ENERGY 279.74 MBTU 22.8 KBTU/SQFT-YR GROSS-AREA 23.0 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 840.07 MBTU 68.4 KBTU/SQFT-YR GROSS-AREA 69.0 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 7.7
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. 80227 EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 5/ 2/1995 9:51:26 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 8025 BN ADMIN & CLRM
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-FAN-SYS TOPEKA, KS

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	H E A T I N G		MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP			TIME OF MAX DY HR	DRY- BULB TEMP		WET- BULB TEMP	ELEC- TRICAL ENERGY (KWH)
MAY	20.32384	31	18	90.F	76.F	0.000			0.000	3215.	28.237
JUN	59.24684	28	18	89.F	76.F	0.000			0.000	6919.	28.237
JUL	77.20629	1	16	86.F	80.F	0.000			0.000	6888.	28.237
AUG	79.84695	24	17	95.F	77.F	0.000			0.000	7883.	28.237
SEP	36.72924	7	15	92.F	76.F	0.000			0.000	6024.	28.237
OCT	0.48520	1	17	85.F	68.F	0.000			0.000	9.	0.392
TOTAL	273.838					0.000				30939.	
MAX					257.113				0.000		28.237

EMC ENGINEERS INC. 80227 EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 5/ 2/1995 9:51:26 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 8025 BN ADMIN & CLRM
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-FAN-SYS TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				H O U R S				C O I N C I D E N T		E L E C	
	COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	COINCIDENT HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT ELECTRIC LOAD AT COOLING PEAK (KW)	COINCIDENT HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	384	0	0	24	0	384	408	0	0	24	0.000	28.237	0.000	28.237	0.000	28.237
JUN	720	0	0	0	0	720	720	0	0	0	0.000	28.237	0.000	28.237	0.000	28.237
JUL	744	0	0	0	0	744	744	0	0	0	0.000	28.237	0.000	28.237	0.000	28.237
AUG	744	0	0	0	0	744	744	0	0	0	0.000	28.237	0.000	28.237	0.000	28.237
SEP	718	0	0	2	0	720	720	0	0	2	0.000	28.237	0.000	28.237	0.000	28.237
OCT	24	0	0	0	0	24	24	0	0	0	0.000	0.392	0.000	0.392	0.000	0.392
ANNUAL	3334	0	0	26	0	3336	3360	0	0	26						

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY TOTAL (MBTU) PEAK (KBTU) DY/HR	NATURAL-GAS TOTAL (MBTU) PEAK (KBTU) DY/HR
MAY	19.623 174.067 31/18	19.623 174.067 31/18	0.000 0.000 31/1
JUN	45.927 175.688 28/17	45.927 175.688 28/17	0.000 0.000 30/1
JUL	51.608 180.500 22/18	51.608 180.500 22/18	0.000 0.000 31/1
AUG	56.631 182.307 23/16	56.631 182.307 23/16	0.000 0.000 31/1
SEP	36.112 178.052 7/16	36.112 178.052 7/16	0.000 0.000 30/1
OCT	0.329 22.660 1/17	0.329 22.660 1/17	0.000 0.000 1/1
ONE YEAR USE/PEAK		210.229 182.307	0.000 0.000

D4-30

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.00	0.00
SPACE COOL	99.50	0.00
HVAC AUX	29.08	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	70.06	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	11.59	0.00
TOTAL	210.23	0.00

TOTAL SITE ENERGY 210.23 MBTU 17.1 KBTU/SQFT-YR GROSS-AREA 17.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 631.32 MBTU 51.4 KBTU/SQFT-YR GROSS-AREA 51.8 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 6.8
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 3 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	395.07	271.93	123.14	136.24
Annual Natural Gas (MBTU)	986.18	794.49	191.69	212.09
Electric Demand June (KW)	42.58	37.07	5.51	6.10
Electric Demand July (KW)	42.60	39.28	3.31	3.67
Electric Demand August (KW)	43.61	41.98	1.63	1.81

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 6 (sq.ft.)	5780
ECO Model Bldg 3 (sq.ft.)	6395
Square Footage Adjustment Factor	1.106

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE: 05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 3 - Replace; STM BLR, Cool Tower, and SZ AHU, w/; HW BLR, ACC, & VAV AHU

A. CONSTRUCTION COST	=	\$61,166
B. SIOH COST	(5.5% of 1A) =	\$3,364
C. DESIGN COST	(6.0% of 1A) =	\$3,670
D. TOTAL COST	(1A + 1B + 1C) =	\$68,200
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$68,200

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	136	\$1,649	15.88	\$26,178
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	212	\$874	18.30	\$15,991
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$131	14.88	\$1,944
F. TOTAL		348	\$2,653		-----> \$44,113

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	\$724	14.88	\$10,770
2		\$0	14.88	\$0
3		\$0	14.88	\$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$724		\$10,770

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	\$48,583	5	0.863	\$41,927
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$48,583			\$41,927

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$52,697

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$5,806
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	11.75
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$96,810
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	1.42

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET		1		OF		1	
		DATE PREPARED		4-May-95					
		ESTIMATOR		C. Wohler					
		CHECKED BY		A. Niemeyer					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 3							
2		PROPOSED SYSTEM MODIFICATIONS							
3		NEW SYSTEMS INSTALLATION							
4	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	1.0	\$4,433	\$4,433	Q-6	40.00	\$804
5	HWBLR4	400 MBH HW BOILER, PWR BURNER, CONTROLS	EA.	1.0	\$5,184	\$5,184	Q-6	30.00	\$603
6	WCHLR1	20 TON WATER CHILLER, RECIP., AIR COOLED	EA.	1.0	\$11,144	\$11,144	Q-7	91.43	\$1,879
7	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	40.0	\$5.28	\$211	Q-15	0.34	\$264
8	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	30.0	\$3.91	\$117	Q-1	0.25	\$145
9	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	98.0	\$2.95	\$289	Q-1	0.20	\$380
10		VALVES AND FITTINGS ADD 15%				\$93			\$118
11	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	40.0	\$1.60	\$64	Q-14	0.09	\$66
12	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	30.0	\$1.46	\$44	Q-14	0.08	\$46
13	INSLPIP1.5	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	98.0	\$1.40	\$137	Q-14	0.08	\$144
14	DUCT2000	GAL. STEEL DUCTWORK, 1000 TO 2000 LB.	LB.	1600.0	\$0.45	\$713	Q-10	0.09	\$2,829
15	DTINSL0.5	0.5" FIBERGLASS LINER, 2LB DENSITY	S.F.	1200.0	\$0.37	\$442	Q-14	0.04	\$928
16	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	5.0	\$271.32	\$1,357	1-SHEE	1.13	\$118
17	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	\$310.08	\$620	1-SHEE	1.48	\$62
18	REHEAT1.5	REHEAT COIL, 2ROW, 1.5'x1'	EA.	1.0	\$129.36	\$129	Q-5	1.32	\$26
19	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	2.0	\$154.07	\$308	Q-5	1.32	\$51
20	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	5.0	\$24.23	\$121	1-ELEC	0.80	\$84
21	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	50.0	\$0.83	\$42	1-ELEC	0.06	\$67
22	WIRE#6	COPPER WIRING #6	C.L.F.	1.5	\$24.71	\$37	1-ELEC	1.23	\$39
23	WIRE#12	COPPER WIRING #12	C.L.F.	3.0	\$7.41	\$22	1-ELEC	0.73	\$46
24	VSD5	VARIABLE SPEED DRIVE W/ CONTRLR,5HP	EA.	1.0	\$2,444.79	\$2,445	1-ELEC	10.50	\$220
25		EXISTING SYSTEMS DEMOLITION							
26		BOILER DEMOLITION	EA.	1.0			Q-6	20.00	\$402
27		DUCTWORK DEMOLITION	EA.	1.0			Q-5	40.00	\$776
28		SZ AHU & H&V UNIT DEMOLITION	TON	3.0			Q-5	14.55	\$846
29		COOLING TOWER DEMOLITION	TON	2.0			Q-5	14.55	\$564
30		PIPING DEMOLITION	L.F.	250.0			1-PLUM	0.04	\$215
31		SUBTOTAL				\$27,952			\$11,721
32	OH	OVERHEAD			17%	\$4,696			\$1,969
33	PRO	PROFIT			10%	\$3,265			\$1,369
34	CONT	CONTINGENCY			20%	\$7,182			\$3,012
35		TOTAL COST				\$43,095			\$18,072

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF	1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95		
						ESTIMATOR		C. Wohler		
						CHECKED BY		A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 3								
2		NON-RECURRING								
3										
4										
5	STMBLR2	BASELINE - EXISTING EQUIP. REPLACEMENT								
6	AHU5400	1,000 MBH STEAM BOILER (Cast Iron)	EA.	1.0	\$6,686.10	\$6,686	Q-7	80	\$1,644	\$8,330
7	VNTFAN1	5,400 CFM AHU, COOLING ONLY	EA.	1.0	\$3,803.33	\$3,803	Q-6	30	\$603	\$4,406
8	CT1	6700 CFM UTILITY FAN, V-BELT DRIVE	EA.	1.0	\$1,090.13	\$1,090	Q-20	6.667	\$128	\$1,218
9	STMCOIL	COOLING TOWER, <60 TONS	TON-AC	20.0	\$96.90	\$1,938	Q-6	23.75	\$9,550	\$11,488
10	DTMOD1	36X36 STEAM COIL	EA.	1.0	\$494.19	\$494	Q-5	5.926	\$115	\$609
11	STLPIP3	MODIFY DUCTWORK FOR STEAM COIL	EA.	1.0	\$193.80	\$194	Q-5	20	\$388	\$582
12		STEEL PIPE SCH. 40, 3" WHANGERS	L.F.	100.0	\$6.40	\$640	Q-15	0.372	\$721	\$1,361
13	INSLPIP3	VALVES AND FITTINGS ADD 15%				\$96			\$108	\$204
14	CUPIP0.7	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	100.0	\$1.66	\$166	Q-14	0.094	\$173	\$339
15		COPPER PIPE TYPE L, 0.75" WHANGERS	L.F.	100.0	\$1.84	\$184	1-PLUM	0.105	\$226	\$410
16		VALVES AND FITTINGS ADD 15%				\$28			\$34	\$62
17										
18										
19		EXISTING SYSTEMS DEMOLITION								
20		BOILER DEMOLITION	EA.	1.0			Q-6	18.00	\$362	\$362
21		DUCTWORK DEMOLITION	EA.	1.0			Q-5	12.00	\$233	\$233
22		SZ AHU & H&V UNIT DEMOLITION	TON	4.0			Q-5	14.55	\$1,128	\$1,128
23		COOLING TOWER DEMOLITION	TON	2.0			Q-5	14.55	\$564	\$564
24		PIPING DEMOLITION	L.F.	250.0			1-PLUM	0.04	\$215	\$215
25										
26										
27										
28										
29										
30										
31		SUBTOTAL				\$15,318			\$16,193	\$31,512
32	OH	OVERHEAD			17%	\$2,573			\$2,720	\$5,294
33	PRO	PROFIT			10%	\$1,789			\$1,891	\$3,681
34	CONT	CONTINGENCY			20%	\$3,936			\$4,161	\$8,097
35	TOTAL COST					\$23,617			\$24,966	\$48,583

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 3							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	1.0	\$48.45	\$48	Q-6	17	\$342
5	MNT-AHU	MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.	2.0			Q-6	25	\$1,005
6	MNT-CT1	MAINT. ON CLG TOWER, <20 TONS. / YR (EXISTIN	EA.	1.0			Q-6	15	\$302
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$48	-	-	\$1,649
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17		MAINT. ON BOILERS - <2.5 MBH	EA.	1.0	\$48.45	\$48	Q-6	17	\$342
18	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	1.0			Q-6	19	\$382
19	MNT-AHU	MAINT. ON AHU - INSPEC. / YR <= 5000 CFM	EA.	1.0			Q-6	10	\$201
20	MNT-CH1	MAINT. ON CHLR, AIR-CLD, <20 TONS. / YR	EA.	1.0					
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$48	-	-	\$925
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$724

DEMAND LIMITING ANALYSIS BUILDING 3

	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
SUMMER PEAK (KW) = 27812												
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00
200 KVA @ \$4.45	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
NEXT 400 @ \$4.25	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
REMAINING @ \$4.05												
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$486,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	3.67	1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.10
CAPACITY (KW)	32468	34450	26136	20754	26400	22752	27108	25812	23310	21834	21996	30090
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32730	34763	26373	20775	26453	22820	27244	25916	23404	21878	22084	30455
80% SUMMER PEAK (KVA)	27810	27810	27810	27810	27810	27810	27810	27810	27810	27810	27810	27810
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32730	34763	27810	27810	27810	27810	27810	27810	27810	27810	27810	30455
ACTUAL OR 80% PEAK	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00	8890.00
200 KVA @ \$4.45	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
NEXT 400 @ \$4.25	\$130,127.20	\$138,360.40	\$110,202.32	\$110,202.32	\$110,202.32	\$110,202.32	\$110,202.32	\$110,202.32	\$110,202.32	\$110,202.32	\$110,202.32	\$120,914.25
REMAINING @ \$4.05												
SUB DISCOUNT \$.20	(\$6,546.03)	(\$6,952.61)	(\$5,562.09)	(\$5,562.09)	(\$5,562.09)	(\$5,562.09)	(\$5,562.09)	(\$5,562.09)	(\$5,562.09)	(\$5,562.09)	(\$5,562.09)	(\$6,091.07)
CAPACITY CHARGE	\$126,171.17	\$133,997.78	\$107,230.23	\$107,230.23	\$107,230.23	\$107,230.23	\$107,230.23	\$107,230.23	\$107,230.23	\$107,230.23	\$107,230.23	\$117,413.17
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,216.60	\$68,205.12	\$54,564.10	\$54,564.10	\$54,564.10	\$54,564.10	\$54,564.10	\$54,564.10	\$54,564.10	\$54,564.10	\$54,564.10	\$59,753.43
100*KVA @ \$.03404	\$111,413.51	\$118,333.46	\$94,666.77	\$94,666.77	\$94,666.77	\$94,666.77	\$94,666.77	\$94,666.77	\$94,666.77	\$94,666.77	\$94,666.77	\$103,670.08
250*KVA @ \$.03084	\$252,349.64	\$268,023.20	\$209,972.07	\$184,066.47	\$214,418.56	\$214,418.56	\$214,418.56	\$214,418.56	\$214,418.56	\$212,747.67	\$171,113.67	\$234,810.90
EXCESS @ \$.02864	\$109,631.93	\$65,722.38	\$0.00	\$0.00	\$1,025.90	\$51,718.70	\$42,267.50	\$32,816.30	\$38,830.70	\$0.00	\$0.00	\$28,292.09
ENERGY CHARGE	\$537,611.68	\$520,284.16	\$359,202.93	\$333,297.33	\$364,675.33	\$415,368.13	\$405,916.93	\$396,465.73	\$402,480.13	\$361,978.53	\$320,344.53	\$426,526.50
TOTAL CHARGE LESS ECA	\$663,782.85	\$654,281.94	\$486,433.16	\$440,527.56	\$471,905.55	\$522,598.35	\$513,147.15	\$503,695.95	\$509,710.35	\$469,208.76	\$427,574.76	\$543,939.67
SUMMARY												
MONTHLY DIFFERENCE	\$20.22	\$9.97	\$6.70	\$6.70	\$7.98	\$7.98	\$7.98	\$7.98	\$7.98	\$6.70	\$6.70	\$33.75
ANNUAL DIFFERENCE.....		\$130.62										

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/15/1995 14:19: 6 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 3 POST CHAPEL
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES	10	RECTANGULAR	10	OTHER	0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)					

SURFACE	SPACE	- - - G L A S S - - -	- - - W A L L - - -	- - - A R E A (SQFT)	- - - U -VALUE (BTU/HR-SQFT-F)	- - - W A L L + G L A S S - - - U-VALUE (BTU/HR-SQFT-F)	AZIMUTH
	UP-STAIRS	1.021		50.00	0.198	0.236	NORTH-EAST
	BASEMENT	1.021		27.00	0.198	0.348	NORTH-EAST
	UP-STAIRS	1.021		70.00	0.198	0.232	SOUTH-EAST
	BASEMENT	1.021		63.00	0.198	0.334	SOUTH-EAST
	UP-STAIRS	1.021		40.00	0.198	0.222	SOUTH-WEST
	BASEMENT	1.021		18.00	0.198	0.277	SOUTH-WEST
	UP-STAIRS	1.021		100.00	0.198	0.350	NORTH-WEST
	BASEMENT	1.021		108.00	0.198	0.939	NORTH-WEST
	UP-STAIRS	0.000		0.00	0.103	0.103	ROOF
	UP-STAIRS	0.000		0.00	0.103	0.103	ROOF
	BASEMENT	0.000		0.00	0.020	0.020	UNDERGRND
	BASEMENT	0.000		0.00	0.020	0.020	UNDERGRND

5-7 EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/15/1995 14:19: 6 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 3 POST CHAPEL
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	1.021	0.198	0.250	77.00	1144.00	1221.00
SOUTH-EAST	1.021	0.198	0.250	133.00	1957.00	2090.00
SOUTH-WEST	1.021	0.198	0.229	58.00	1493.00	1551.00
NORTH-WEST	1.021	0.198	0.457	208.00	452.00	660.00
ROOF	0.000	0.103	0.103	0.00	5700.00	5700.00
WALL	1.021	0.198	0.269	476.00	5046.00	5522.00
WALLS+ROOFS	1.021	0.148	0.185	476.00	10746.00	11222.00
UNDERGRND	0.000	0.020	0.020	0.00	4144.00	4144.00
BUILDING	1.021	0.112	0.140	476.00	14890.00	15366.00

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/15/1995 14:19: 6 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 3 POST CHAPEL
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 5780 SQFT 537 SQMT
VOLUME 112710 CUFT 3192 CUMT

TIME DRY-BULB TEMP WET-BULB TEMP
AUG 21 11AM 88F 31C
76F 24C
COOLING LOAD
HEATING LOAD
JAN 16 6AM
10F -12C
8F -13C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	16.972	4.971	0.000	0.000	-101.307	-29.670
ROOFS	0.000	0.000	0.000	0.000	0.000	0.000
GLASS CONDUCTION	5.259	1.540	0.000	0.000	-36.212	-10.606
GLASS SOLAR	14.045	4.114	0.000	0.000	1.997	0.585
DOOR	2.209	0.647	0.000	0.000	-4.649	-1.362
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.392	-0.115	0.000	0.000	-2.380	-0.697
OCCUPANTS TO SPACE	68.054	19.931	156.250	45.762	0.879	0.258
LIGHT TO SPACE	15.492	4.537	0.000	0.000	5.193	1.521
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	4.875	1.428	11.614	3.401	-28.961	-8.482
TOTAL	126.515	37.053	167.864	49.163	-165.439	-48.453
TOTAL LOAD	294.378	KBTU/H	86.216	KW	-165.439	KBTU/H
TOTAL LOAD / AREA	50.93	BTU/H.SQFT	160.557	W /SQMT	28.623	BTU/H.SQFT
						W /SQMT

*
* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. DENVER, CO 80227				EZDOE - ELITE SOFTWARE DEVELOPMENT INC EXISTING CONDITION OF BLDG. 3				DOE-2.1D POST CHAPEL TOPEKA, KS				14:19: 6		SDL RUN 1	
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR PACK-COOLU															
MONTH	C O O L I N G				H E A T I N G				E L E C						
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)			
JAN	0.00000				0.000	-128.137	15	3	-8.F	-9.F	6149.	10.598			
FEB	0.00000				0.000	-97.728	3	6	-1.F	-2.F	5550.	10.598			
MAR	0.00000				0.000	-80.561	3	5	15.F	13.F	6145.	10.498			
APR	0.00000				0.000	-29.201	1	1	32.F	29.F	5946.	10.498			
MAY	21.43229	30	11	74.F	69.F	-6.515	5	6	44.F	40.F	8687.	38.487			
JUN	62.08226	26	11	82.F	74.F	0.000				0.000	13407.	42.558			
JUL	87.59253	24	11	82.F	75.F	0.000				0.000	16643.	42.582			
AUG	83.93900	21	11	88.F	76.F	0.000				0.000	16612.	43.594			
SEP	36.20814	5	11	78.F	73.F	0.000				0.000	10346.	41.359			
OCT	0.10583	1	18	83.F	68.F	-25.552	20	8	23.F	22.F	6159.	15.069			
NOV	0.00000				0.000	-65.098	3	4	13.F	12.F	5946.	10.498			
DEC	0.00000				0.000	-116.063	15	2	3.F	2.F	6145.	10.598			
TOTAL	291.360					-548.855					107741.				
MAX					320.118					-287.154		43.594			

EMC ENGINEERS INC.						EZDOE - ELITE SOFTWARE DEVELOPMENT INC	DOE-2.1D	2/15/1995	14:19:	6	SDL RUN 1
DENVER,	CO	80227	EXISTING CONDITION OF BLDG. 3			POST CHAPEL					
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR						PACK-COOLU	TOPEKA, KS				
HOURS COINCIDENT COOL-HEAT LOAD	HOURS HEATING LOAD	N U M B E R	O F	H O U R S	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	744	0	0	744	0	0	-154.749	4.720
FEB	0	672	0	672	0	0	672	0	0	-143.819	4.720
MAR	0	743	1	744	0	0	744	0	1	-144.966	4.720
APR	0	627	93	720	0	0	720	0	93	-43.428	4.720
MAY	340	256	148	360	340	0	744	0	148	0.000	38.460
JUN	683	0	37	0	683	0	720	0	37	0.000	42.395
JUL	744	0	0	0	744	0	744	0	0	0.000	42.582
AUG	744	0	0	0	744	0	744	0	0	0.000	43.594
SEP	491	0	229	0	496	0	720	0	229	0.000	41.359
OCT	5	600	139	720	5	0	744	0	139	0.000	15.069
NOV	0	710	10	720	0	0	720	0	10	-161.721	4.720
DEC	0	744	0	744	0	0	744	0	0	-171.149	4.720
ANNUAL	3007	5096	657	5424	3012	8760	0	0	657		

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 25.737 42.565 28/ 9	NATURAL-GAS 216.912 446.639 15/ 3
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.220 42.565 3/ 8	171.029 413.080 3/ 6
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	25.455 42.224 31/20	148.270 352.488 3/ 5
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	22.598 42.224 23/ 7	59.671 256.160 1/ 1
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	30.292 131.412 22/11	14.542 171.649 5/ 6
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	45.778 145.312 19/11	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	56.827 145.393 24/11	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	56.722 148.847 21/11	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	35.327 141.219 5/11	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.203 51.451 1/18	53.480 256.442 20/ 8
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	24.183 42.224 30/20	122.083 320.906 3/ 4
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	25.715 42.565 13/ 8	200.189 417.287 15/ 2
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	395.056 148.847	986.176 446.639

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	27.19	986.18
SPACE COOL	120.84	0.00
HVAC AUX	141.18	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	105.85	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	395.07	986.18

TOTAL SITE ENERGY 1381.23 MBTU 239.0 KBTU/SQFT-YR GROSS-AREA 239.0 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2172.53 MBTU 375.9 KBTU/SQFT-YR GROSS-AREA 375.9 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-129.298	15	-8.F	-9.F	-270.692	2990.	6.258
FEB	0.00000				0.000	-102.579	3	-5.F	-6.F	-255.634	2701.	6.258
MAR	0.00000				0.000	-87.184	3	14.F	12.F	-212.124	2990.	6.258
APR	0.00000				0.000	-36.821	1	32.F	29.F	-152.512	2933.	8.441
MAY	17.65345	22	11	76.F	65.F	-9.657	5	44.F	40.F	-94.839	3307.	14.489
JUN	50.49638	26	11	82.F	74.F	0.000				0.000	3252.	10.180
JUL	72.67881	24	11	82.F	75.F	0.000				0.000	3633.	10.974
AUG	70.08376	21	11	88.F	76.F	0.000				0.000	3661.	11.228
SEP	32.38507	5	11	78.F	73.F	0.000				0.000	3077.	9.286
OCT	0.63675	1	17	85.F	68.F	-33.057	20	23.F	22.F	-155.286	3060.	13.096
NOV	0.00000				0.000	-71.874	3	13.F	12.F	-202.958	2896.	6.912
DEC	0.00000				0.000	-118.555	13	0.F	-1.F	-244.987	2990.	6.258
TOTAL	243.934				332.738	-589.027				-270.692	37490.	14.489
MAX												

D5-12

MONTH	HOURS				N U M B E R				H O U R S				C O I N C I D E N T				C O I N C I D E N T			
	COOLING LOAD	HEATING LOAD	COOL-HEAT LOAD	COINCIDENT LOAD	FLOATING	HEATING AVAIL.	COOLING AVAIL.	FANS ON	COOLING AVAIL.	FANS ON	HEATING AVAIL.	FANS ON	COOLING AVAIL.	FANS ON	HEATING AVAIL.	FANS ON	COOLING AVAIL.	FANS ON	HEATING AVAIL.	FANS ON
JAN	0	744	0	0	0	744	0	744	0	0	744	0	744	0	744	0	744	0	744	0
FEB	0	672	0	0	0	672	0	672	0	0	672	0	672	0	672	0	672	0	672	0
MAR	0	744	0	0	0	744	0	744	0	0	744	0	744	0	744	0	744	0	744	0
APR	0	689	0	0	31	720	0	720	0	0	720	0	720	0	720	0	720	0	720	0
MAY	383	281	0	0	80	360	384	744	0	0	744	0	744	0	744	0	744	0	744	0
JUN	716	0	0	0	4	0	720	720	0	0	720	0	720	0	720	0	720	0	720	0
JUL	744	0	0	0	0	0	744	744	0	0	744	0	744	0	744	0	744	0	744	0
AUG	744	0	0	0	0	0	744	744	0	0	744	0	744	0	744	0	744	0	744	0
SEP	654	0	0	0	66	0	720	720	0	0	720	0	720	0	720	0	720	0	720	0
OCT	19	676	0	0	49	720	24	744	0	0	744	0	744	0	744	0	744	0	744	0
NOV	0	720	0	0	0	720	0	720	0	0	720	0	720	0	720	0	720	0	720	0
DEC	0	744	0	0	0	744	0	744	0	0	744	0	744	0	744	0	744	0	744	0
ANNUAL	3260	5270	0	0	230	5424	3336	8760	0	0	8760	0	8760	0	8760	0	8760	0	8760	0

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 15.417 28.366 31/20	NATURAL-GAS 165.044 321.545 15/ 4
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	13.923 28.366 28/20	134.129 306.576 3/ 7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	15.304 28.366 31/20	119.268 262.449 3/ 7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	13.433 28.821 27/20	55.678 199.878 1/ 1
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	22.760 100.125 22/11	15.500 137.018 5/ 6
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	34.769 126.510 26/11	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	41.632 134.079 24/11	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	42.095 143.273 21/11	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	28.457 113.783 5/11	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	14.195 56.258 1/17	50.876 202.843 20/ 8
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	14.523 28.366 30/20	100.278 252.986 3/ 4
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	15.417 28.366 31/20	153.717 295.898 13/ 8
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	271.924 143.273	794.489 321.545

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	27.39	794.49
SPACE COOL	105.20	0.00
HVAC AUX	33.49	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	105.85	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	271.93	794.49

TOTAL SITE ENERGY 1066.41 MBTU 184.5 KBTU/SQFT-YR GROSS-AREA 184.5 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1611.08 MBTU 278.7 KBTU/SQFT-YR GROSS-AREA 278.7 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 6.3
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 7086 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	461.14	324.59	136.55	136.55
Annual Natural Gas (MBTU)	833.85	711.52	122.33	122.33
Electric Demand June (KW)	38.76	33.52	5.24	5.24
Electric Demand July (KW)	42.06	38.61	3.45	3.45
Electric Demand August (KW)	40.84	37.66	3.18	3.18

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7086 (sq.ft.)	4590
ECO Model Bldg 7086 (sq.ft.)	4590
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 7086 - Replace Existing SZ w/ VAV AHU w/Reheat

A. CONSTRUCTION COST	=	\$17,292
B. SIOH COST	(5.5% of 1A) =	\$951
C. DESIGN COST	(6.0% of 1A) =	\$1,037
D. TOTAL COST	(1A + 1B + 1C) =	\$19,280
E. SALVAGE VALUE OF EXISTING EQUIPMENT =		\$0
F. PUBLIC UTILITY COMPANY REBATE =		\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$19,280

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	92	\$1,108	15.88	\$17,591
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	122	\$504	18.30	\$9,223
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$183	14.88	\$2,719
F. TOTAL		214	\$1,794		-----> \$29,533

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$0
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-)				\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$12,554	5	0.863	\$10,834
b.				\$0
c.				\$0
d. TOTAL	\$12,554			\$10,834

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = \$10,834

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bd1/Economic Life)) \$2,422

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 7.96

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$40,367

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 2.09
(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET 1 OF 1		DATE PREPARED 4-May-95		ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7086							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5	AHU5400	5,400 CFM AHU, COOLING ONLY	EA.	1.0	\$3,803.33	\$3,803	Q-6	30	\$603
6	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	1.0	\$2,238.39	\$2,238	1-ELEC	10.5	\$220
7	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	\$310.08	\$620	1-SHEE	1.48	\$62
8	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	2.0	\$154.07	\$308	Q-5	1.32	\$51
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	\$24.23	\$48	1-ELEC	0.8	\$33
10	WIRE#12	COPPER WIRING #12	C.L.F.	3.0	\$7.41	\$22	1-ELEC	0.727	\$46
11	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	100.0	\$2.10	\$210	Q-1	0.151	\$293
12		FITTINGS, 5%				\$11			\$15
13	CNTV1	CONTROL VALVE 1"	EA.	2.0	\$190.89	\$382	1-PLUM	0.471	\$20
14	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	100.0	\$0.62	\$62	Q-14	0.073	\$134
15	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	500.0	\$0.47	\$233	Q-10	0.094	\$913
16	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	300.0	\$0.83	\$250	Q-14	0.053	\$293
17									
18									
19									
20									
21									
22									
23		EXISTING SYSTEM DEMOLITION							
24		AHU DEMOLITION	TON	1.0			Q-5	17.778	\$345
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$8,188			\$3,028
32	OH	OVERHEAD			17%	\$1,376			\$509
33	PRO	PROFIT			10%	\$956			\$354
34	CONT	CONTINGENCY			20%	\$2,104			\$778
35	TOTAL COST		-	-	-	\$12,624	-	-	\$4,668

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT				Fort Riley Feasibility Study for HVAC Upgrade			SHEET 1 OF 1		
ENGINEER				E M C Engineers, Inc. Denver, CO			DATE PREPARED 4-May-95		
							ESTIMATOR C. Wohler		
							CHECKED BY A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7086							
2		NON-RECURRING							
3		NEW SYSTEMS INSTALLATION							
4									
5	AHUH5400	5,400 CFM AHU	EA.	1.0	\$4,563.99	Q-6	31.5	\$633	\$5,197
6	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	\$24.23	1-ELEC	0.8	\$17	\$41
7	WIRE#12	COPPER WIRING #12	C.L.F.	1.5	\$7.41	1-ELEC	0.727	\$23	\$34
8	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	60.0	\$2.10	Q-1	0.151	\$176	\$302
9		FITTINGS, 5%			\$6			\$9	\$15
10	CNTV1	CONTROL VALVE 1"	EA.	2.0	\$190.89	1-PLUM	0.471	\$20	\$402
11	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	60.0	\$0.62	Q-14	0.073	\$81	\$118
12	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	500.0	\$0.47	Q-10	0.094	\$913	\$1,146
13	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	300.0	\$0.83	Q-14	0.053	\$293	\$543
14									
15									
16									
17									
18									
19									
20									
21									
22		EXISTING SYSTEM DEMOLITION							
23		AHU DEMOLITION	TON	1.0		Q-5	17.778	\$345	\$345
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL			\$5,633			\$2,509	\$8,142
32	OH	OVERHEAD			17%			\$422	\$1,368
33	PRO	PROFIT			10%			\$293	\$951
34	CONT	CONTINGENCY			20%			\$645	\$2,092
35	TOTAL COST				\$8,685			\$3,868	\$12,554

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED 4-May-95			
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR C. Wohler			
										CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			Total	TOTAL		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total				
1		BUILDING 7086											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	-	\$0	\$0	\$0	
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	-	\$0	\$0	\$0	
30													
31													
32													
33													
34													
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	-	\$0	\$0	\$0	

DEMAND LIMITING ANALYSIS BUILDING 7086

	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
SUMMER PEAK (KW) = 27812												
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK			80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	3.45	3.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.24
CAPACITY (KW)	32469	34449	26136	20754	26400	22752	27108	25812	23310	21834	21996	30091
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32730	34762	26373	20775	26453	22820	27244	25916	23404	21878	22084	30456
80% SUMMER PEAK (KVA)	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32730	34762	27809	27809	27809	27809	27809	27809	27809	27809	27809	30456
ACTUAL OR 80% PEAK			80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,128.10	\$138,354.80	\$110,197.84	\$110,197.84	\$110,197.84	\$110,197.84	\$110,197.84	\$110,197.84	\$110,197.84	\$110,197.84	\$110,197.84	\$120,917.77
SUB DISCOUNT \$.20	(\$6,546.08)	(\$6,952.34)	(\$5,561.87)	(\$5,561.87)	(\$5,561.87)	(\$5,561.87)	(\$5,561.87)	(\$5,561.87)	(\$5,561.87)	(\$5,561.87)	(\$5,561.87)	(\$6,091.25)
CAPACITY CHARGE	\$126,172.02	\$133,992.47	\$107,225.97	\$107,225.97	\$107,225.97	\$107,225.97	\$107,225.97	\$107,225.97	\$107,225.97	\$107,225.97	\$107,225.97	\$117,416.52
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,217.03	\$68,202.41	\$54,561.93	\$54,561.93	\$54,561.93	\$54,561.93	\$54,561.93	\$54,561.93	\$54,561.93	\$54,561.93	\$54,561.93	\$59,755.14
100*KVA @ \$.03404	\$111,414.26	\$118,328.76	\$94,663.01	\$94,663.01	\$94,663.01	\$94,663.01	\$94,663.01	\$94,663.01	\$94,663.01	\$94,663.01	\$94,663.01	\$103,673.04
250*KVA @ \$.03084	\$252,351.34	\$268,012.55	\$209,977.18	\$184,071.58	\$214,410.04	\$214,410.04	\$214,410.04	\$214,410.04	\$214,410.04	\$212,752.78	\$171,118.78	\$234,817.60
EXCESS @ \$.02864	\$109,629.40	\$65,738.20	\$0.00	\$0.00	\$1,038.56	\$51,731.36	\$42,280.16	\$32,828.96	\$38,843.36	\$0.00	\$0.00	\$28,282.13
ENERGY CHARGE	\$537,612.04	\$520,281.92	\$359,202.11	\$333,296.51	\$364,673.54	\$415,366.34	\$405,915.14	\$396,463.94	\$402,478.34	\$361,977.71	\$320,343.71	\$426,527.91
TOTAL CHARGE LESS ECA	\$663,784.06	\$654,274.39	\$466,428.09	\$440,522.49	\$471,899.51	\$522,592.31	\$513,141.11	\$503,689.91	\$509,704.31	\$469,203.69	\$427,569.69	\$543,944.43
SUMMARY												
MONTHLY DIFFERENCE	\$19.02	\$17.53	\$11.77	\$11.77	\$14.02	\$14.02	\$14.02	\$14.02	\$14.02	\$11.77	\$11.77	\$28.99
ANNUAL DIFFERENCE.....		\$182.72										

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8: 7:52 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7086 UNIT CHAPEL
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 4590 SQFT 426 SQMT
VOLUME 123930 CUFT 3510 CUMT

COOLING LOAD

TIME
DRY-BULB TEMP
WET-BULB TEMP

JUL 23 4PM
98F 37C
79F 26C

HEATING LOAD

JAN 4 3AM
8F -13C
7F -14C

	SENSIBLE (KBTU/H) (KW)		LATENT (KBTU/H) (KW)		SENSIBLE (KBTU/H) (KW)	
WALLS	8.170	2.393	0.000	0.000	-31.018	-9.084
ROOFS	12.808	3.751	0.000	0.000	-32.144	-9.414
GLASS CONDUCTION	22.230	6.511	0.000	0.000	-62.587	-18.330
GLASS SOLAR	9.508	2.785	0.000	0.000	0.436	0.128
DOOR	0.776	0.227	0.000	0.000	-1.512	-0.443
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.824	-0.241	0.000	0.000	-2.636	-0.772
OCCUPANTS TO SPACE	6.543	1.916	9.375	2.746	0.188	0.055
LIGHT TO SPACE	30.393	8.901	0.000	0.000	4.408	1.291
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	12.063	3.533	17.769	5.204	-57.812	-16.932
TOTAL	101.666	29.775	27.144	7.950	-182.676	-53.501
TOTAL LOAD	128.810	KBTU/H	37.725	KW	-182.676	KBTU/H
TOTAL LOAD / AREA	28.06	BTU/H.SQFT	88.469	W /SQMT	39.799	BTU/H.SQFT
						W /SQMT

*
* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* --- LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8: 7:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7086 UNIT CHAPEL
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AC-1 TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				-132.870	15	-8.F	-9.F	-321.525	7046.	14.737	
FEB	0.00000				-101.107	3	-1.F	-2.F	-287.310	6360.	14.737	
MAR	0.00000				-84.020	3	16.F	13.F	-252.079	7041.	14.637	
APR	0.00000				-30.302	5	31.F	28.F	-161.000	6814.	14.637	
MAY	20.62210	31	16	88.F	-6.965	5	44.F	40.F	-106.771	9025.	34.720	
JUN	64.83260	19	10	82.F	0.000				0.000	13111.	38.743	
JUL	92.03951	24	10	80.F	0.000				0.000	15954.	42.044	
AUG	89.48664	21	10	86.F	0.000				0.000	16048.	40.818	
SEP	38.51266	6	16	93.F	0.000				0.000	10579.	39.252	
OCT	0.16323	1	17	85.F	-26.102	20	24.F	23.F	-167.285	7059.	20.972	
NOV	0.00000				-66.373	2	15.F	14.F	-217.994	6814.	14.637	
DEC	0.00000				-120.204	15	8.F	7.F	-290.509	7041.	14.737	
TOTAL	305.657				-567.944				-321.525	112900.		
MAX											42.044	

D5-23

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8: 7:52 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7086 UNIT CHAPEL
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR AC-1 TOPEKA, KS

MONTH	HOURS				HOURS				HOURS				COINCIDENT LOADS--			
	COOLING LOAD	HEATING LOAD	COOL-HEAT LOAD	COINCIDENT LOAD	COOLING AVAIL.	HEATING AVAIL.	FLOATING	HEATING AVAIL.	COOLING AVAIL.	FANS ON CYCLE ON	NIGHT VENTING	FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK	ELECTRIC LOAD AT COOLING PEAK		
JAN	0	744	0	0	744	0	0	744	0	0	0	0	-159.635	4.543		
FEB	0	672	0	0	672	0	0	672	0	0	0	0	-157.478	4.543		
MAR	0	736	0	0	744	0	0	744	0	0	0	8	-158.809	4.543		
APR	0	602	0	0	720	0	0	720	0	0	0	118	-56.766	4.543		
MAY	291	257	0	0	360	293	0	744	0	0	0	196	0.000	34.720		
JUN	651	0	0	0	0	651	0	720	0	0	0	69	0.000	38.743		
JUL	740	0	0	0	0	740	0	744	0	0	0	4	0.000	39.366		
AUG	733	0	0	0	0	733	0	744	0	0	0	11	0.000	40.818		
SEP	452	0	0	0	455	4	0	720	0	0	0	268	0.000	39.252		
OCT	4	569	0	0	720	720	0	744	0	0	0	171	0.000	20.972		
NOV	0	687	0	0	720	0	0	720	0	0	0	33	-180.423	4.543		
DEC	0	744	0	0	744	0	0	744	0	0	0	0	-178.018	4.543		
ANNUAL	2871	5011	0	0	5424	2876	8760	8760	0	0	0	878				

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY TOTAL (MBTU) PEAK (KBTU) DY/HR	NATURAL-GAS TOTAL (MBTU) PEAK (KBTU) DY/HR
JAN	29.557 184.608 57.754	29.557 184.608 57.754	184.608 405.590 15/ 3
FEB	26.637 145.332 57.754	26.637 145.332 57.754	145.332 369.390 3/ 6
MAR	29.002 125.834 57.413	29.002 125.834 57.413	125.834 331.368 3/ 4
APR	25.781 49.913 57.413	25.781 49.913 57.413	49.913 229.553 5/ 6
MAY	31.553 118.549 31/16	31.553 118.549 31/16	12.528 166.524 5/ 5
JUN	44.766 132.286 19/10	44.766 132.286 19/10	0.000 0.000 30/ 1
JUL	54.473 143.556 23/16	54.473 143.556 23/16	0.000 0.000 31/ 1
AUG	54.794 139.370 21/10	54.794 139.370 21/10	0.000 0.000 31/ 1
SEP	36.121 134.024 6/16	36.121 134.024 6/16	0.000 0.000 30/ 1
OCT	26.460 71.608 1/17	26.460 71.608 1/17	44.078 236.742 20/ 6
NOV	27.506 57.413 30/17	27.506 57.413 30/17	101.395 293.859 2/ 6
DEC	29.494 57.754 13/ 8	29.494 57.754 13/ 8	170.162 372.805 15/ 5
ONE YEAR USE/PEAK	416.143 143.556	416.143 143.556	833.850 405.590

ENERGY TYPE		ELECTRICITY		NATURAL-GAS	
IN SITE MBTU -					
CATEGORY OF USE					
SPACE HEAT		29.19		833.85	
SPACE COOL		102.39		0.00	
HVAC AUX		137.38		0.00	
DOM HOT WTR		0.00		0.00	
AUX SOLAR		0.00		0.00	
LIGHTS		147.18		0.00	
VERT TRANS		0.00		0.00	
MISC EQUIP		0.00		0.00	
		-----		-----	
TOTAL		416.14		833.85	
TOTAL SITE ENERGY		1249.99 MBTU		272.3 KBTU/SQFT-YR	
TOTAL SOURCE ENERGY		2083.53 MBTU		453.9 KBTU/SQFT-YR	
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =		0.0		272.3 KBTU/SQFT-YR	
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED		= 0.0		453.9 KBTU/SQFT-YR	
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED					
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.					

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 9: 1: 2 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7086 UNIT CHAPEL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR VAV-1 TOPEKA, KS

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-108.898	15	4	-8.F	-9.F	5327.	12.333
FEB	0.00000				0.000	-88.874	3	7	-5.F	-6.F	4811.	12.333
MAR	0.00000				0.000	-76.273	4	6	14.F	12.F	5327.	12.333
APR	0.00000				0.000	-30.855	5	7	30.F	27.F	5356.	18.478
MAY	14.95665	31	16	88.F	75.F	-7.685	5	5	44.F	40.F	5648.	18.478
JUN	44.24454	19	10	82.F	74.F	0.000				0.000	5185.	13.611
JUL	62.78404	24	10	80.F	75.F	0.000				0.000	5395.	15.089
AUG	62.74154	21	10	86.F	76.F	0.000				0.000	5452.	15.150
SEP	28.79925	6	16	93.F	76.F	0.000				0.000	5179.	14.281
OCT	0.56231	1	17	85.F	68.F	-26.972	20	6	24.F	23.F	5653.	18.478
NOV	0.00000				0.000	-62.157	3	5	13.F	12.F	5200.	18.478
DEC	0.00000				0.000	-101.031	13	8	0.F	-1.F	5327.	12.333
TOTAL	214.088					-502.745					63857.	
MAX					254.689							18.478

D5-26

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 9: 1: 2 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7086 UNIT CHAPEL
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR VAV-1 TOPEKA, KS

MONTH	N U M B E R O F H O U R S				C O I N C I D E N T				C O I N C I D E N T			
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING LOAD	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	
JAN	0	744	0	0	744	0	0	0	0	-137.583	2.239	
FEB	0	672	0	0	672	0	0	0	0	-139.303	2.239	
MAR	0	741	0	3	744	0	0	0	3	-137.559	2.239	
APR	0	620	0	100	720	0	0	0	100	-55.470	2.239	
MAY	384	245	0	115	384	384	0	0	115	0.000	12.604	
JUN	720	0	0	0	720	720	0	0	0	0.000	13.611	
JUL	744	0	0	0	744	744	0	0	0	0.000	14.763	
AUG	744	0	0	0	744	744	0	0	0	0.000	14.868	
SEP	682	0	0	38	720	720	0	0	38	0.000	14.281	
OCT	20	582	0	142	24	24	0	0	142	0.000	12.333	
NOV	0	700	0	20	720	0	0	0	20	-149.868	2.239	
DEC	0	744	0	0	744	0	0	0	0	-145.648	2.239	
ANNUAL	3294	5048	0	418	5424	3336	8760	0	418			

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 22.006 47.241 31/17	NATURAL-GAS 147.115 279.902 15/ 4
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	19.864 47.241 28/17	122.308 267.492 3/ 7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	21.816 47.241 31/17	109.022 228.882 4/ 6
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	20.454 63.093 3/10	48.360 192.899 5/ 7
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	26.553 99.317 31/16	12.973 145.581 5/ 5
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	35.268 114.415 19/10	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	41.549 131.786 23/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	42.499 128.531 21/10	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	29.999 118.250 6/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	21.628 65.519 1/17	43.145 204.940 20/ 6
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	20.945 63.093 22/16	90.278 226.808 3/ 5
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	22.002 47.241 31/17	138.319 258.682 13/ 8
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	324.583 131.786	711.519 279.902

EMC ENGINEERS INC. 80227 EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 9: 1: 2 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7086 UNIT CHAPEL
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE		
IN SITE MBTU -		
CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	21.76	711.52
SPACE COOL	81.42	0.00
HVAC AUX	74.24	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	147.18	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	324.59	711.52

TOTAL SITE ENERGY 1036.10 MBTU 225.7 KBTU/SQFT-YR GROSS-AREA 225.7 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1686.24 MBTU 367.4 KBTU/SQFT-YR GROSS-AREA 367.4 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 22.6
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 602 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1270.02	773.16	496.86	571.81
Annual Natural Gas (MBTU)	608.64	702.31	-93.67	-107.80
Electric Demand June (KW)	105.22	84.17	21.05	24.22
Electric Demand July (KW)	107.29	86.63	20.66	23.78
Electric Demand August (KW)	109.05	89.04	20.01	23.03

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7665 (sq.ft.)	9645
ECO Model Bldg 602 (sq.ft.)	11100
Square Footage Adjustment Factor	1.151

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005	
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995	
ANALYSIS DATE:	05/08/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohler

1. INVESTMENT: BLDG 602 - Convert DD AHUs to DDs with VAV Units

A. CONSTRUCTION COST	=	\$31,697
B. SIOH COST	(5.5% of 1A) =	\$1,743
C. DESIGN COST	(6.0% of 1A) =	\$1,902
D. TOTAL COST	(1A + 1B + 1C) =	\$35,342
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$35,342

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	681	\$8,237	15.88	\$130,809
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(132)	(\$546)	18.30	(\$9,984)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$1,242	14.88	\$18,480
F. TOTAL		548	\$8,934		-----> \$139,305

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-)	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$0			\$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$8,934

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 3.96

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$139,305

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 3.94

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 8-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohliert		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 602							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4	VSD25	VARIABLE SPEED DRIVE W/ CONTRLER, 25HP	EA.	1	\$5,426.40	\$5,426	1-ELEC	25	\$523
5	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	44	\$24.23	\$1,066	1-ELEC	0.8	\$737
6	WIRE#12	COPPER WIRING #12	C.L.F.	9	\$7.41	\$67	1-ELEC	0.727	\$137
7	VAVBX5	VAV BOX, 500 CFM, ELEC	EA.	37	\$327.00	\$12,099	1-SHEE	1.48	\$1,140
8	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	5	\$331.40	\$1,657	1-SHEE	1.5	\$156
9	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	1	\$334.30	\$334	1-SHEE	1.7	\$35
10	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	1	\$345.90	\$346	1-SHEE	1.83	\$38
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26		DUAL DUCT MIXING BOX DEMO	EA.	44.0			1-SHEE	3	\$2,747
27									
28									
29									
30									
31		SUBTOTAL				\$15,569			\$20,559
32	OH	OVERHEAD			17%	\$2,616			\$3,454
33	PRO	PROFIT			10%	\$1,818			\$2,401
34	CONT	CONTINGENCY			20%	\$4,001			\$5,283
35	TOTAL COST					\$24,003			\$31,697

ENGINEER'S OPINION OF PROBABLE COST

PROJECT

ENGINEER **EM C Engineers, Inc.**

Denver, CO

SHEET 1 OF 1

DATE PREPARED

ESTIMATOR	C. Wohler
------------------	-----------

CHECKED BY A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 602								
2		NON-RECURRING								
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32	OH	SUBTOTAL			17%	\$0				\$0
33	PRO	OVERHEAD			10%	\$0				\$0
34	CONT	PROFIT			20%	\$0				\$0
35	TOTAL COST	CONTINGENCY				\$0				\$0

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF	1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		1-Mar-95		
						ESTIMATOR		C. Wohliert		
						CHECKED BY		A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 602								
2		ANNUAL RECURRING								
3		ANNUAL MAINTENANCE COST - BASELINE								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0	\$0
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT								
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0	\$0
30										
31										
32										
33										
34										
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0	\$0

DEMAND LIMITING ANALYSIS BUILDING 602

SUMMER PEAK (KW) = 27812	1993												1993	
	JUL BILL 7/1-8/2 ACTUAL	AUG BILL 8/2-9/1 ACTUAL	SEP BILL 9/3-10/1 ACTUAL	OCT BILL 10/1-11/1 ACTUAL	NOV BILL 11/1-12/1 ACTUAL	DEC BILL 12/1-1/3 ACTUAL	JAN BILL 1/4-2/1 ACTUAL	FEB BILL 2/1-3/1 ACTUAL	MAR BILL 3/3-4/1 ACTUAL	APR BILL 4/1-5/3 ACTUAL	MAY BILL 5/3-6/1 ACTUAL	JUN BILL 6/1-7/1 ACTUAL	1993	
BASE CASE														
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096	1993	
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%	1993	
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462	1993	
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	1993	
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	1993	
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462	1993	
ACTUAL OR 80% PEAK	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	1993	
200 KVA @ \$4.45	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	1993	
NEXT 400 @ \$4.25	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23	1993	
REMAINING @ \$4.05	\$6,546.77	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)	1993	
SUB DISCOUNT \$20													1993	
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92	1993	
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000	1993	
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54	1993	
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08	1993	
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46	1993	
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42	1993	
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49	1993	
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42	1993	
DEMAND REDUCTION (KW)														
CAPACITY (KW)	23.78	23.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.22	1993	
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%	1993	
CAPACITY (KVA)	32710	34742	26373	20775	26453	22820	27244	25916	23404	21878	22084	30437	1993	
80% SUMMER PEAK (KVA)	27793	27793	27793	27793	27793	27793	27793	27793	27793	27793	27793	27793	1993	
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	1993	
BILLING CAPACITY (KVA)	32710	34742	27793	27793	27793	27793	27793	27793	27793	27793	27793	30437	1993	
ACTUAL OR 80% PEAK	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	890.00	1993	
200 KVA @ \$4.45	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	1993	
NEXT 400 @ \$4.25	\$130,045.11	\$138,273.68	\$110,132.94	\$110,132.94	\$110,132.94	\$110,132.94	\$110,132.94	\$110,132.94	\$110,132.94	\$110,132.94	\$110,132.94	\$120,839.93	1993	
REMAINING @ \$4.05	(\$6,541.98)	(\$6,948.33)	(\$5,558.66)	(\$5,558.66)	(\$5,558.66)	(\$5,558.66)	(\$5,558.66)	(\$5,558.66)	(\$5,558.66)	(\$5,558.66)	(\$5,558.66)	(\$6,087.40)	1993	
SUB DISCOUNT \$20													1993	
CAPACITY CHARGE	\$126,093.13	\$133,915.35	\$107,164.28	\$107,164.28	\$107,164.28	\$107,164.28	\$107,164.28	\$107,164.28	\$107,164.28	\$107,164.28	\$107,164.28	\$117,342.52	1993	
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000	1993	
50*KVA @ \$.03924	\$64,176.83	\$68,163.12	\$54,530.49	\$54,530.49	\$54,530.49	\$54,530.49	\$54,530.49	\$54,530.49	\$54,530.49	\$54,530.49	\$54,530.49	\$59,717.43	1993	
100*KVA @ \$.03404	\$111,344.51	\$118,260.57	\$94,608.46	\$94,608.46	\$94,608.46	\$94,608.46	\$94,608.46	\$94,608.46	\$94,608.46	\$94,608.46	\$94,608.46	\$103,607.61	1993	
250*KVA @ \$.03084	\$252,193.35	\$267,858.12	\$210,051.30	\$184,145.70	\$214,286.49	\$214,286.49	\$214,286.49	\$214,286.49	\$214,286.49	\$212,826.90	\$171,192.90	\$234,669.42	1993	
EXCESS @ \$.02864	\$109,864.15	\$65,967.67	\$0.00	\$0.00	\$1,222.13	\$51,914.93	\$42,463.73	\$33,012.53	\$39,026.93	\$0.00	\$0.00	\$28,502.31	1993	
ENERGY CHARGE	\$537,578.84	\$520,249.47	\$359,190.26	\$333,284.66	\$364,647.58	\$415,340.38	\$405,889.18	\$396,437.98	\$402,452.38	\$361,965.86	\$320,331.86	\$426,496.77	1993	
TOTAL CHARGE LESS ECA	\$663,671.97	\$654,164.82	\$466,354.54	\$440,448.94	\$471,811.86	\$522,504.66	\$513,053.46	\$503,602.26	\$509,616.66	\$469,130.14	\$427,496.14	\$543,839.30	1993	
SUMMARY														
MONTHLY DIFFERENCE	\$131.11	\$127.09	\$85.32	\$85.32	\$101.67	\$101.67	\$101.67	\$101.67	\$101.67	\$101.67	\$85.32	\$134.12	1993	
ANNUAL DIFFERENCE.....		\$1,241.96											1993	

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 602 DOE-2.1D 3/16/1995 8:30:20 LDL RUN 1
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT DENTAL CLINIC
TOPEKA, KS

NUMBER OF EXTERIOR SURFACES	14	RECTANGULAR	14	OTHER	0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)					

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	SPACE_3	0.490	39.60	0.209	420.40	0.233	460.00	NORTH
	PLENUM_6	0.000	0.00	0.209	172.50	0.209	172.50	NORTH
	PLENUM_6	0.000	0.00	0.209	504.00	0.209	504.00	EAST
	SPACE_2	0.490	198.00	0.209	1146.00	0.251	1344.00	EAST
	PLENUM_6	0.000	0.00	0.209	172.50	0.209	172.50	SOUTH
	SPACE_4	0.490	78.00	0.209	382.00	0.257	460.00	SOUTH
	PLENUM_6	0.000	0.00	0.209	504.00	0.209	504.00	WEST
	SPACE_1	0.490	312.00	0.209	1032.00	0.274	1344.00	WEST
	SPACE_5	0.000	0.00	0.087	3795.00	0.087	3795.00	ROOF
	SPACE_1	0.000	0.00	0.087	2295.00	0.087	2295.00	ROOF
	SPACE_3	0.000	0.00	0.087	637.50	0.087	637.50	ROOF
	SPACE_2	0.000	0.00	0.087	2295.00	0.087	2295.00	ROOF
	SPACE_4	0.000	0.00	0.087	637.50	0.087	637.50	ROOF
	PLENUM_6	0.000	0.00	0.087	9660.00	0.087	9660.00	ROOF
	SPACE_1	0.000	0.00	0.020	2295.00	0.020	2295.00	UNDERGRND
	SPACE_2	0.000	0.00	0.020	2295.00	0.020	2295.00	UNDERGRND
	SPACE_3	0.000	0.00	0.020	637.50	0.020	637.50	UNDERGRND
	SPACE_4	0.000	0.00	0.020	637.50	0.020	637.50	UNDERGRND
	SPACE_5	0.000	0.00	0.020	3795.00	0.020	3795.00	UNDERGRND

EMC ENGINEERS INC.	EZDOE - ELITE SOFTWARE DEVELOPMENT INC	DOE-2.1D	3/16/1995	8:30:20	LDL RUN 1
DENVER, CO	80227 EXISTING CONDITION OF BLDG. 602	DENTAL CLINIC			
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT		TOPEKA, KS			

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.490	0.209	0.227	39.60	592.90	632.50
EAST	0.490	0.209	0.239	198.00	1650.00	1848.00
SOUTH	0.490	0.209	0.244	78.00	554.50	632.50
WEST	0.490	0.209	0.257	312.00	1536.00	1848.00
ROOF	0.000	0.087	0.087	0.00	19320.00	19320.00
ALL WALLS	0.490	0.209	0.245	627.60	4333.40	4961.00
WALLS+ROOFS	0.490	0.109	0.119	627.60	23653.40	24281.00
UNDERGRND	0.000	0.020	0.020	0.00	9660.00	9660.00
BUILDING	0.490	0.083	0.091	627.60	33313.40	33941.00

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:30:20 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 602 DENTAL CLINIC
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 9645 SQFT 896 SQMT
VOLUME 106268 CUFT 3010 CUMT

TIME DRY-BULB TEMP WET-BULB TEMP
AUG 11 4PM 38C 22C
COOLING LOAD
HEATING LOAD
JAN 15 8AM
-6F -21C
-7F -22C

	SENSIBLE (KBTU/H) (KW)		LATENT (KBTU/H) (KW)		SENSIBLE (KBTU/H) (KW)	
WALLS	8.794	2.576	0.000	0.000	-46.897	-13.735
ROOFS	44.911	13.153	0.000	0.000	-71.534	-20.950
GLASS CONDUCTION	7.254	2.124	0.000	0.000	-24.039	-7.040
GLASS SOLAR	23.372	6.845	0.000	0.000	0.990	0.290
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.914	-0.268	0.000	0.000	-5.547	-1.625
OCCUPANTS TO SPACE	7.862	2.303	14.353	4.204	0.285	0.083
LIGHT TO SPACE	107.528	31.492	0.000	0.000	6.010	1.760
EQUIPMENT TO SPACE	31.414	9.200	0.000	0.000	1.138	0.333
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	230.221	67.426	14.353	4.204	-139.593	-40.883
TOTAL LOAD	244.573	KBTU/H	71.629	KW	-139.593	-40.883
TOTAL LOAD / AREA	25.36	BTU/H.SQFT	79.939	W /SQMT	14.473	45.626

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:30:20 SDL RUN 1											
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 602 DENTAL CLINIC											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL_DUCT TOPEKA, KS											
----- C O O L I N G ----- H E A T I N G ----- E L E C -----											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-57.426	15	-6. F	-7. F	-218.388	25516.	67.457
FEB	0.00000				-39.102	3	-1. F	-2. F	-179.002	23062.	67.457
MAR	0.00000				-44.015	6	19. F	18. F	-136.201	26440.	67.457
APR	0.00000				-56.338	22	67. F	52. F	-165.788	25006.	67.457
MAY	60.03765	16	62. F	59. F	-33.741	13	80. F	66. F	-182.360	25516.	67.457
JUN	125.61597	28	90. F	76. F	0.000				0.000	25468.	67.457
JUL	142.58212	13	93. F	77. F	0.000				0.000	25054.	67.457
AUG	144.29832	23	96. F	77. F	0.000				0.000	26440.	67.457
SEP	100.69760	7	93. F	76. F	0.000				0.000	25006.	67.457
OCT	1.60873	1	83. F	68. F	-51.112	6	67. F	52. F	-157.027	25054.	67.457
NOV	0.00000				-38.996	23	63. F	52. F	-129.139	24544.	67.457
DEC	0.00000				-47.896	12	3. F	2. F	-185.054	25516.	67.457
TOTAL	574.841				-368.626					302611.	
MAX									-218.388		67.457

D6-6

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:30:20 SDL RUN 1											
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 602 DENTAL CLINIC											
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL_DUCT TOPEKA, KS											
----- N U M B E R O F H O U R S -----											
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	0	0	0	-53.279	21.255
FEB	0	672	0	0	672	0	0	0	0	-47.569	21.255
MAR	0	744	0	0	744	0	0	0	0	-59.268	21.255
APR	0	720	0	0	720	0	0	0	0	-93.275	21.255
MAY	384	360	0	0	360	384	0	0	0	0.000	21.255
JUN	720	0	0	0	0	720	0	0	0	0.000	21.255
JUL	744	0	0	0	0	744	0	0	0	0.000	67.457
AUG	744	0	0	0	0	744	0	0	0	0.000	67.457
SEP	720	0	0	0	0	720	0	0	0	0.000	67.457
OCT	24	720	0	0	720	24	0	0	0	0.000	21.255
NOV	0	720	0	0	720	0	0	0	0	-58.184	21.255
DEC	0	744	0	0	744	0	0	0	0	-111.254	21.255
ANNUAL	3336	5424	0	0	5424	3336	8760	0	0		

EMC DENVER, REPORT- PS-B		ENGINEERS CO 80227	INC. MONTHLY PEAK AND TOTAL ENERGY USE	EZDOE - ELITE SOFTWARE DEVELOPMENT INC EXISTING CONDITION OF BLDG. 602	DOE-2.1D 3/16/1995	8:30:20	PDL RUN 1
				DENTAL CLINIC TOPEKA, KS			

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY	NATURAL-GAS				
JAN	90.363 235.181 28/10	91.393 293.361 15/ 8					
FEB	81.563 235.181 25/16	66.359 248.719 3/ 6					
MAR	93.633 235.181 31/16	75.746 198.523 6/ 7					
APR	88.817 235.181 29/16	91.527 233.409 22/18					
MAY	110.498 354.062 16/15	52.689 252.582 13/18					
JUN	132.744 359.126 28/16	0.000 30/ 1					
JUL	137.623 366.189 22/16	0.000 31/ 1					
AUG	144.414 372.178 11/16	0.000 31/ 1					
SEP	123.696 362.746 7/16	0.000 30/ 1					
OCT	89.603 235.181 31/16	84.105 223.166 6/18					
NOV	86.815 235.181 30/16	67.485 190.072 23/18					
DEC	90.285 235.181 23/16	79.335 255.675 12/ 6					
ONE YEAR USE/PEAK		1270.055 372.178	608.638 293.361				

D6-10

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:30:20 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 602 DENTAL CLINIC
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE		
IN SITE MBTU -	ELECTRICITY	NATURAL-GAS
CATEGORY OF USE		
SPACE HEAT	24.03	608.64
SPACE COOL	187.62	0.00
HVAC AUX	660.84	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.83	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	1270.02	608.64

TOTAL SITE ENERGY 1878.69 MBTU 194.5 KBTU/SQFT-YR GROSS-AREA 194.8 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 4422.62 MBTU 457.8 KBTU/SQFT-YR GROSS-AREA 458.5 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC										DOE-2.1D 3/16/1995 8:33:21 SDL RUN 1															
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 602										DENTAL CLINIC															
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR										DUAL DUCT TOPEKA, KS															
-- C O O L I N G --										H E A T I N G --															
MONTH	COOLING ENERGY (MBTU)				TIME OF MAX DY HR				DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR				DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)				MAXIMUM ELEC LOAD (KW)		
	MAXIMUM COOLING LOAD (KBTU/HR)																								
JAN	0.00000				0.000					-99.970	15	7	-7.7	-8.7	-294.778	11324.	67.436							67.436	
FEB	0.00000				0.000					-74.409	3	6	-1.7	-2.7	-261.983	10440.	67.436							67.436	
MAR	0.00000				0.000					-59.934	14	6	15.7	13.7	-221.552	14416.	67.436							67.436	
APR	0.00000				0.000					-32.239	4	6	32.7	31.7	-142.807	15928.	67.436							67.436	
MAY	29.15188	16	16	80.7	68.7	281.222	0.000	0.000		-14.285	13	1	69.7	64.7	-98.890	15078.	67.436							67.436	
JUN	71.47971	28	16	90.7	76.7	306.793	0.000	0.000		0.000					0.000	12730.	67.436							67.436	
JUL	85.68158	13	16	93.7	77.7	321.658	0.000	0.000		0.000					0.000	11370.	67.436							67.436	
AUG	89.44794	23	16	96.7	77.7	320.574	0.000	0.000		0.000					0.000	13033.	67.436							67.436	
SEP	48.54211	7	16	93.7	76.7	305.178	0.000	0.000		0.000					0.000	12106.	67.436							67.436	
OCT	0.10436	1	18	83.7	68.7	27.479	0.000	0.000		-25.425	31	6	44.7	39.7	-117.493	15731.	67.436							67.436	
NOV	0.00000				0.000					-52.250	3	6	13.7	12.7	-205.326	13236.	67.436							67.436	
DEC	0.00000				0.000					-89.954	12	6	3.7	2.7	-258.103	11301.	67.292							67.292	
TOTAL	324.408									-448.465															156697.
MAX						321.658																			67.436

D6-12

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC										DOE-2.1D 3/16/1995 8:33:21 SDL RUN 1											
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 602										DENTAL CLINIC											
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR										DUAL_DUCT TOPEKA, KS											
-- N U M B E R O F H O U R S --										--COINCIDENT LOADS--											
MONTH	HOURS COOL-HEAT LOAD				HOURS HEATING AVAIL.				HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON				HOURS FLOATING WHEN FANS ON				HEATING LOAD AT COOLING PEAK (KBTU/HR)		ELECTRIC LOAD AT COOLING PEAK (KW)	
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS ON		HOURS NIGHT VENTING	HOURS FLOATING	HOURS FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)							
JAN	0	744	0	0	744	0	744	0	0	0	0	0	0	0	0	-119.820	0.978				
FEB	0	672	0	0	672	0	672	0	0	0	0	0	0	0	0	-109.444	0.978				
MAR	0	744	0	0	744	0	744	0	0	0	0	0	0	0	0	-100.393	0.978				
APR	0	720	0	0	720	0	720	0	0	0	0	0	0	0	0	-61.483	3.962				
MAY	291	360	0	93	360	384	744	0	0	0	93	0.000	54.735								
JUN	626	0	0	94	0	720	720	0	0	94	29	0.000	54.158								
JUL	715	0	0	29	0	744	744	0	0	0	29	0.000	54.824								
AUG	705	0	0	39	0	744	744	0	0	0	39	0.000	54.776								
SEP	483	0	0	237	0	720	720	0	0	0	237	0.000	54.155								
OCT	8	720	0	16	720	24	744	0	0	0	16	0.000	0.978								
NOV	0	720	0	0	720	0	720	0	0	0	0	-147.855	0.978								
DEC	0	744	0	0	744	0	744	0	0	0	0	-183.170	0.978								
ANNUAL	2828	5424	0	508	5424	3336	8760	0	0	0	508										

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY	NATURAL-GAS
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	43.076 233.308 24/15	151.156 395.976 15/7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	39.446 233.258 14/16	116.271 359.041 3/6
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	52.940 233.854 31/15	98.163 312.458 14/6
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	57.215 232.490 22/8	58.697 218.401 4/6
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	63.175 275.480 31/16	26.467 164.036 13/1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	68.918 287.284 28/16	0.000 0.000 30/1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	69.555 295.677 13/16	0.000 0.000 31/1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	77.397 303.856 11/16	0.000 0.000 31/1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	59.121 290.162 7/16	0.000 0.000 30/1
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	56.124 232.936 20/11	47.272 187.232 31/6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.594 233.030 1/13	86.812 293.436 3/6
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	42.951 232.694 20/15	138.865 354.621 12/6
	ONE YEAR USE/PEAK	678.511 303.856	723.704 395.976

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:33:21 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 602 DENTAL CLINIC
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	26.14	723.70
SPACE COOL	105.21	0.00
HVAC AUX	149.61	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.82	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	678.49	723.70

TOTAL SITE ENERGY 1402.21 MBTU 145.2 KBTU/SQFT-YR GROSS-AREA 145.4 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 2761.27 MBTU 285.8 KBTU/SQFT-YR GROSS-AREA 286.3 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 27.5
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.



BUILDING 7665 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	995.96	695.40	300.56	300.56
Annual Natural Gas (MBTU)	597.83	704.54	-106.71	-106.71
Electric Demand June (KW)	95.98	83.10	12.89	12.89
Electric Demand July (KW)	98.68	86.20	12.48	12.48
Electric Demand August (KW)	100.00	88.28	11.71	11.71

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7665 (sq.ft.)	9645
ECO Model Bldg 7665 (sq.ft.)	9645
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 7665 - Convert Existing MZ to VAV AHUs

A. CONSTRUCTION COST	=	\$10,951
B. SIOH COST	(5.5% of 1A) =	\$602
C. DESIGN COST	(6.0% of 1A) =	\$657
D. TOTAL COST	(1A + 1B + 1C) =	\$12,210
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$12,210

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	JAN '95 DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	301	\$3,637	15.88	\$57,752
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(107)	(\$440)	18.30	(\$8,046)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$637	14.88	\$9,479
F. TOTAL		194	\$3,834		-----> \$59,185

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$0
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-)				\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0
b.				\$0
c.				\$0
d. TOTAL	\$0			\$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = \$0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bd1/Economic Life)) \$3,834

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 3.18

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$59,185

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 4.85

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF	1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95		
						ESTIMATOR		C. Wohler		
						CHECKED BY		A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST				TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total		
1		BUILDING 7665								
2		PROPOSED SYSTEM MODIFICATIONS								
3										
4										
5	VSD15	VARIABLE SPEED DRIVE W/ CONTRLER,15HP	EA.	1.0	\$4,060.11	1-ELEC	19	\$398		\$4,458
6	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	6.0	\$24.23	1-ELEC	0.8	\$100		\$246
7	WIRE#12	COPPER WIRING #12	C.L.F.	7.0	\$7.41	1-ELEC	0.727	\$107		\$158
8	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	2.0	\$271.32	1-SHEE	1.13	\$47		\$590
9	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	2.0	\$287.31	1-SHEE	1.33	\$55		\$630
10	VAVBX70	VAV BOX, 7000 CFM, ELEC	EA.	2.0	\$353.69	1-SHEE	2.6	\$108		\$816
11	ELE-SWIT	DDC SWITCH	EA.	1.0	\$69.77	1-STPI	0.5	\$11		\$81
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		EXISTING SYSTEMS DEMOLITION								
26		ZONE DUCTWORK DEMOLITION	EA.	6.0		1-SHEE	1	\$125		\$125
27										
28										
29										
30										
31		SUBTOTAL								\$7,103
32	OH	OVERHEAD			17%				\$951	\$1,193
33	PRO	PROFIT			*10%				\$160	\$830
34	CONT	CONTINGENCY			20%				\$111	\$1,825
35	TOTAL COST								\$244	\$10,951

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 28-Feb-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7665							
2		NON-RECURRING							
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$0			\$0
32	OH	OVERHEAD			17%	\$0			\$0
33	PRO	PROFIT			10%	\$0			\$0
34	CONT	CONTINGENCY			20%	\$0			\$0
35	TOTAL COST					\$0			\$0

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF 1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		1-Mar-95	
						ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7665							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0

DEMAND LIMITING ANALYSIS BUILDING 7665

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	12.48	11.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.89
CAPACITY (KW)	32460	34440	26136	20754	26400	22752	27108	25812	23310	21834	21996	30083
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32721	34753	26373	20775	26453	22820	27244	25916	23404	21878	22084	30448
80% SUMMER PEAK (KVA)	27802	27802	27802	27802	27802	27802	27802	27802	27802	27802	27802	27802
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32721	34753	27802	27802	27802	27802	27802	27802	27802	27802	27802	30448
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,091.23	\$138,319.91	\$110,169.93	\$110,169.93	\$110,169.93	\$110,169.93	\$110,169.93	\$110,169.93	\$110,169.93	\$110,169.93	\$110,169.93	\$120,886.40
SUB DISCOUNT \$.20	(\$6,544.26)	(\$6,950.61)	(\$5,560.49)	(\$5,560.49)	(\$5,560.49)	(\$5,560.49)	(\$5,560.49)	(\$5,560.49)	(\$5,560.49)	(\$5,560.49)	(\$5,560.49)	(\$6,089.70)
CAPACITY CHARGE	\$126,136.97	\$133,959.30	\$107,199.44	\$107,199.44	\$107,199.44	\$107,199.44	\$107,199.44	\$107,199.44	\$107,199.44	\$107,199.44	\$107,199.44	\$117,386.70
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,199.17	\$68,185.51	\$54,548.41	\$54,548.41	\$54,548.41	\$54,548.41	\$54,548.41	\$54,548.41	\$54,548.41	\$54,548.41	\$54,548.41	\$59,739.95
100*KVA @ \$.03404	\$111,383.28	\$118,299.43	\$94,639.55	\$94,639.55	\$94,639.55	\$94,639.55	\$94,639.55	\$94,639.55	\$94,639.55	\$94,639.55	\$94,639.55	\$103,646.68
250*KVA @ \$.03084	\$252,281.16	\$267,946.13	\$210,009.06	\$184,103.46	\$214,356.90	\$214,356.90	\$214,356.90	\$214,356.90	\$214,356.90	\$212,784.66	\$171,150.66	\$234,757.89
EXCESS @ \$.02864	\$109,733.68	\$65,836.89	\$0.00	\$0.00	\$1,117.51	\$51,810.31	\$42,359.11	\$32,907.91	\$38,922.31	\$0.00	\$0.00	\$28,370.85
ENERGY CHARGE	\$537,597.29	\$520,267.96	\$359,197.01	\$333,291.41	\$364,662.37	\$415,355.17	\$405,903.97	\$396,452.77	\$402,467.17	\$361,972.61	\$320,338.61	\$426,515.36
TOTAL CHARGE LESS ECA	\$663,734.26	\$654,227.26	\$466,396.45	\$440,490.85	\$471,861.81	\$522,554.61	\$513,103.41	\$503,652.21	\$509,666.61	\$469,172.05	\$427,538.05	\$543,902.06
SUMMARY												
MONTHLY DIFFERENCE	\$68.81	\$64.65	\$43.40	\$43.40	\$51.72	\$51.72	\$51.72	\$51.72	\$51.72	\$43.40	\$43.40	\$71.35
ANNUAL DIFFERENCE.....		\$637										

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.490	0.209	0.227	39.60	592.90	632.50
EAST	0.490	0.209	0.239	198.00	1650.00	1848.00
SOUTH	0.490	0.209	0.244	78.00	554.50	632.50
WEST	0.490	0.209	0.257	312.00	1536.00	1848.00
ROOF	0.000	0.087	0.087	0.00	19320.00	19320.00
ALL WALLS	0.490	0.209	0.245	627.60	4333.40	4961.00
WALLS+ROOFS	0.490	0.109	0.119	627.60	23653.40	24281.00
UNDERGRND	0.000	0.020	0.020	0.00	9660.00	9660.00
BUILDING	0.490	0.083	0.091	627.60	33313.40	33941.00

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 8:45:43 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7665 DENTAL CLINIC
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 9645 SQFT 896 SQMT
VOLUME 106268 CUFT 3010 CUMT

COOLING LOAD

TIME
DRY-BULB TEMP
WET-BULB TEMP

AUG 11 4PM
100F 38C
71F 22C

HEATING LOAD

JAN 15 8AM
-6F -21C
-7F -22C

	SENSIBLE (KBTU/H)	(KW)	LATENT (KBTU/H)	(KW)		SENSIBLE (KBTU/H)	(KW)	
WALLS	8.794	2.576	0.000	0.000		-46.897	-13.735	
ROOFS	44.911	13.153	0.000	0.000		-71.534	-20.950	
GLASS CONDUCTION	7.254	2.124	0.000	0.000		-24.039	-7.040	
GLASS SOLAR	23.372	6.845	0.000	0.000		0.990	0.290	
DOOR	0.000	0.000	0.000	0.000		0.000	0.000	
INTERNAL SURFACES	0.000	0.000	0.000	0.000		0.000	0.000	
UNDERGROUND SURFACES	-0.914	-0.268	0.000	0.000		-5.547	-1.625	
OCCUPANTS TO SPACE	7.862	2.303	14.353	4.204		0.285	0.083	
LIGHT TO SPACE	107.528	31.492	0.000	0.000		6.010	1.760	
EQUIPMENT TO SPACE	31.414	9.200	0.000	0.000		1.138	0.333	
PROCESS TO SPACE	0.000	0.000	0.000	0.000		0.000	0.000	
INFILTRATION	0.000	0.000	0.000	0.000		0.000	0.000	
TOTAL	230.221	67.426	14.353	4.204		-139.593	-40.883	
TOTAL LOAD	244.573	KBTU/H	71.629	KW		-139.593	KBTU/H	
TOTAL LOAD / AREA	25.36	BTU/H.SQFT	79.939	W /SQMT		14.473	BTU/H.SQFT	W /SQMT

*
* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 8:45:43 SDL RUN 1											
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7665 DENTAL CLINIC											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ_W/DX TOPEKA, KS											
MONTH	C O O L I N G				H E A T I N G				E L E C		
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-71.674	15	-6.F	-7.F	-248.524	19885.	63.387
FEB	0.00000				-50.246	3	-1.F	-2.F	-213.459	17843.	63.387
MAR	0.00000				-43.945	14	15.F	13.F	-174.703	20637.	59.657
APR	0.00000				-37.770	22	67.F	52.F	-125.590	19390.	59.657
MAY	49.29276	16	4	60.F	-21.970	13	80.F	66.F	-133.556	24525.	93.094
JUN	108.18748	28	16	90.F	0.000				0.000	30710.	95.943
JUL	125.02094	13	16	93.F	334.093				0.000	32005.	98.637
AUG	126.65778	23	16	96.F	346.475				0.000	33980.	99.954
SEP	82.42660	7	16	93.F	345.451				0.000	27613.	97.000
OCT	1.01279	1	18	83.F	332.205	6	18	67.F	-123.197	19358.	59.657
NOV	0.00000				103.075	3	6	13.F	-152.486	18928.	59.657
DEC	0.00000				-37.450	12	6	3.F	-212.982	19717.	63.387
TOTAL	492.598				-61.674						
MAX					-357.689					284594.	99.954

EMC ENGINEERS INC.		EZDOE - ELITE SOFTWARE DEVELOPMENT INC		DOE-2.1D		3/1/1995		8:45:43		SDL RUN 1	
DENVER, CO	80227	EXISTING CONDITION OF BLDG. 7665		DENTAL CLINIC							
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR		MZ W/DX		TOPEKA, KS							
		N U M B E R O F		H O U R S							
HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	744	0	744	0	0	0	-50.099	13.455
FEB	0	672	0	672	0	744	0	0	0	-44.812	13.455
MAR	0	744	0	744	0	744	0	0	0	-51.198	13.455
APR	0	720	0	720	0	720	0	0	0	-65.631	13.455
MAY	384	360	0	360	384	744	0	0	0	0.000	50.696
JUN	0	0	0	0	720	720	0	0	0	0.000	95.943
JUL	744	0	0	0	744	744	0	0	0	0.000	98.637
AUG	744	0	0	0	744	744	0	0	0	0.000	99.891
SEP	692	0	28	0	720	720	0	0	28	0.000	97.000
OCT	17	720	7	720	24	744	0	0	7	0.000	24.993
NOV	0	720	0	720	0	720	0	0	0	-81.400	13.455
DEC	0	744	0	744	0	744	0	0	0	-140.673	13.455
ANNUAL	3301	5424	35	5424	3336	8760	0	0	35		

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 71.497 221.954 28/ 9	NATURAL-GAS 111.266 333.842 15/ 8
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	64.007 221.954 3/ 8	81.921 294.241 3/ 6
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	73.767 209.218 18/16	75.567 249.270 14/ 6
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	69.471 209.218 28/16	67.610 190.465 22/18
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	85.435 317.861 16/16	38.028 200.142 13/18
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	104.858 327.591 28/16	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	109.280 336.790 13/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	116.022 341.287 11/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	94.283 331.199 7/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	68.962 209.218 26/16	59.389 187.549 6/18
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	67.571 209.218 23/16	65.410 222.921 3/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	70.834 221.954 13/ 8	98.646 293.695 12/ 6
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	995.986 341.287	597.835 333.842

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 8:45:43 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7665 DENTAL CLINIC
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	24.27	597.83
SPACE COOL	171.73	0.00
HVAC AUX	402.41	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.84	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	995.96	597.83

TOTAL SITE ENERGY 1593.82 MBTU 165.0 KBTU/SQFT-YR GROSS-AREA 165.2 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 3588.79 MBTU 371.5 KBTU/SQFT-YR GROSS-AREA 372.1 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.5
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC.				EZDOE - ELITE SOFTWARE DEVELOPMENT INC				DOE-2.1D		2/22/1995		14:52: 3		SDL RUN 1		
DENVER, CO 80227				PROPOSED MODIFICATION OF BLDG. 7665				DENTAL CLINIC								
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR				MZ_W/DX				TOPEKA, KS								
COOLING				HEATING				H E A T I N G				E L C				
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)				
JAN	0.00000				0.000	-98.610	15	-7.F	-8.F	-293.164	13027.	59.644				
FEB	0.00000				0.000	-73.201	3	-1.F	-2.F	-260.375	11782.	59.644				
MAR	0.00000				0.000	-57.754	14	6	15.F	13.F	15145.	59.644				
APR	0.00000				0.000	-30.262	5	6	31.F	28.F	15274.	59.644				
MAY	29.21634	16	2	62.F	59.F	-13.737	6	18	66.F	53.F	17420.	78.786				
JUN	70.66007	28	16	90.F	76.F	0.000				0.000	20390.	83.061				
JUL	84.48312	13	16	93.F	77.F	0.000				0.000	20834.	86.164				
AUG	88.16418	23	16	96.F	77.F	0.000				0.000	23078.	88.246				
SEP	48.10788	7	16	93.F	76.F	0.000				0.000	17694.	84.015				
OCT	0.11864	1	18	83.F	68.F	-23.892	31	6	44.F	39.F	14989.	59.644				
NOV	0.00000				0.000	-50.102	3	6	13.F	12.F	13668.	59.644				
DEC	0.00000				0.000	-88.418	12	6	3.F	2.F	12881.	59.644				
TOTAL	320.750					-435.977					196188.					
MAX					311.718					-293.164					88.246	

28

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:52: 3 SDL RUN 1									
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7665 DENTAL CLINIC									
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ_W/DX	TOPEKA, KS								

		N U M B E R O F				H O U R S		--COINCIDENT LOADS--	
		HOURS		HOURS		HOURS		HOURS	
		COOL-HEAT		COOLING		FANS ON		HEATING	
		LOAD		AVAIL.		CYCLE ON		LOAD AT	
		LOAD		AVAIL.		VENTING		PEAK	
		LOAD		AVAIL.		FANS ON		(KBTU/HR)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON		(KW)	
		LOAD		AVAIL.		FANS ON			

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 48.841 206.535 31/14	NATURAL-GAS 149.171 393.807 15/ 7
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	43.975 206.223 15/15	114.450 356.878 3/ 6
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	55.321 206.893 31/13	94.823 309.993 14/ 6
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	54.857 206.814 8/ 8	55.507 216.652 5/ 6
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	60.765 269.010 31/16	25.641 157.743 6/18
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	69.621 283.606 28/16	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	71.134 294.200 13/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	78.798 301.311 11/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	60.416 286.863 7/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	53.392 206.371 20/11	44.806 184.313 31/ 6
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	49.968 206.954 2/15	83.551 292.632 3/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.282 205.716 1/14	136.590 352.475 12/ 6
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	695.369 301.311	704.539 393.807

ENERGY TYPE			
IN SITE MBTU -			
CATEGORY OF USE	ELECTRICITY	NATURAL-GAS	
SPACE HEAT	25.52	704.54	
SPACE COOL	114.36	0.00	
HVAC AUX	157.97	0.00	
DOM HOT WTR	0.00	0.00	
AUX SOLAR	0.00	0.00	
LIGHTS	310.84	0.00	
VERT TRANS	0.00	0.00	
MISC EQUIP	86.71	0.00	
TOTAL	695.40	704.54	

TOTAL SITE ENERGY 1399.91 MBTU 144.9 KBTU/SQFT-YR GROSS-AREA / 145.1 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2792.74 MBTU 289.1 KBTU/SQFT-YR GROSS-AREA 289.6 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 29.8
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 7670 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1270.02	678.49	591.53	889.29
Annual Natural Gas (MBTU)	608.64	723.70	-115.06	-172.98
Electric Demand June (KW)	95.98	83.10	12.89	19.37
Electric Demand July (KW)	98.68	86.20	12.48	18.76
Electric Demand August (KW)	100.00	88.28	11.71	17.61

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7665 (sq.ft.)	9645
ECO Model Bldg 7670 (sq.ft.)	14500
Square Footage Adjustment Factor	1.503

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE:	05/08/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 7670 - Convert DD AHUs to DDs with VAV Units

A. CONSTRUCTION COST	=	\$36,193
B. SIOH COST	(5.5% of 1A) =	\$1,991
C. DESIGN COST	(6.0% of 1A) =	\$2,172
D. TOTAL COST	(1A + 1B + 1C) =	\$40,355
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$40,355

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

	ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A.	ELECT.	\$12.10	889	\$10,760	15.88	\$170,875
B.	DIST	\$0.00	0	\$0	19.16	\$0
C.	NAT GAS	\$4.12	(173)	(\$713)	18.30	(\$13,042)
D.	COAL	\$0.00	0	\$0	16.62	\$0
E.	ELEC. DEMAND			\$958	14.88	\$14,255
F.	TOTAL		716	\$11,006		-----> \$172,088

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

	ANNUAL MAINTENANCE	ANNUAL \$	DISCOUNT	DISCOUNTED
1		\$0	14.88	\$0
2		\$0	14.88	\$0
3		\$0	14.88	\$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST (-)	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$0			\$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$11,006
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	3.67
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$172,088
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	4.26

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT Fort Riley Feasibility Study for HVAC Upgrade									
ENGINEER E M C Engineers, Inc. Denver, CO									
SHEET 1 OF 1									
DATE PREPARED 8-May-95									
ESTIMATOR C. Wohler									
CHECKED BY A. Niemeyer									
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7670							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4	VSD15	VARIABLE SPEED DRIVE W/ CONTRLER, 15HP	EA.	1	\$4,060.11	\$4,060	1-ELEC	38	\$795
5	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	50	\$24.23	\$1,211	1-ELEC	0.8	\$837
6	WIRE#12	COPPER WIRING #12	C.L.F.	10	\$7.41	\$74	1-ELEC	0.727	\$152
7	VAVBX5	VAV BOX, 500 CFM, ELEC	EA.	36	\$327.00	\$11,772	1-SHEE	1.48	\$1,109
8	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	7	\$331.40	\$2,320	1-SHEE	1.5	\$219
9	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	2	\$334.30	\$669	1-SHEE	1.7	\$71
10	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	5	\$345.90	\$1,730	1-SHEE	1.83	\$190
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26		DUAL DUCT MIXING BOX DEMO	EA.	50.0			1-SHEE	3	\$3,122
27									
28									
29									
30									
31		SUBTOTAL				\$17,775			\$5,700
32	OH	OVERHEAD			17%	\$2,986			\$958
33	PRO	PROFIT			10%	\$2,076			\$666
34	CONT	CONTINGENCY			20%	\$4,568			\$1,465
35	TOTAL COST					\$27,405			\$8,788
									\$23,475
									\$3,944
									\$2,742
									\$6,032
									\$36,193

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET 1 OF 1		DATE PREPARED		1-Mar-95	
ENGINEER		E M C Engineers, Inc. Denver, CO		ESTIMATOR		C. Wohler		CHECKED BY	
A. Niemeyer									
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST		TOTAL	
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7670							
2		NON-RECURRING							
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$0			\$0
32	OH	OVERHEAD			17%	\$0			\$0
33	PRO	PROFIT			10%	\$0			\$0
34	CONT	CONTINGENCY			20%	\$0			\$0
35		TOTAL COST				\$0			\$0

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 1-Mar-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohliert		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7670							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0

DEMAND LIMITING ANALYSIS BUILDING 7670

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
200 KVA @ \$4.45												
NEXT 400 @ \$4.25												
REMAINING @ \$4.05												
SUB DISCOUNT \$.20												
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	18.76	17.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.37
CAPACITY (KW)	32453	34434	26136	20754	26400	22752	27108	25812	23310	21834	21996	30077
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32715	34747	26373	20775	26453	22820	27244	25916	23404	21878	22084	30442
80% SUMMER PEAK (KVA)	27798	27798	27798	27798	27798	27798	27798	27798	27798	27798	27798	27798
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32715	34747	27798	27798	27798	27798	27798	27798	27798	27798	27798	30442
ACTUAL OR 80% PEAK												
200 KVA @ \$4.45												
NEXT 400 @ \$4.25												
REMAINING @ \$4.05												
SUB DISCOUNT \$.20												
CAPACITY CHARGE	\$126,112.59	\$133,936.39	\$107,181.12	\$107,181.12	\$107,181.12	\$107,181.12	\$107,181.12	\$107,181.12	\$107,181.12	\$107,181.12	\$107,181.12	\$117,361.42
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,186.75	\$68,173.84	\$54,539.07	\$54,539.07	\$54,539.07	\$54,539.07	\$54,539.07	\$54,539.07	\$54,539.07	\$54,539.07	\$54,539.07	\$59,727.06
100*KVA @ \$.03404	\$111,361.72	\$118,279.18	\$94,623.34	\$94,623.34	\$94,623.34	\$94,623.34	\$94,623.34	\$94,623.34	\$94,623.34	\$94,623.34	\$94,623.34	\$103,624.32
250*KVA @ \$.03084	\$252,232.34	\$267,900.26	\$210,031.08	\$184,125.48	\$214,320.21	\$214,320.21	\$214,320.21	\$214,320.21	\$214,320.21	\$212,806.68	\$171,172.68	\$234,707.27
EXCESS @ \$.02864	\$109,806.22	\$65,905.05	\$0.00	\$0.00	\$1,172.04	\$51,864.84	\$42,413.64	\$32,962.44	\$38,976.84	\$0.00	\$0.00	\$28,446.07
ENERGY CHARGE	\$537,587.03	\$520,258.33	\$359,193.49	\$333,287.89	\$364,654.66	\$415,347.46	\$405,896.26	\$396,445.06	\$402,459.46	\$361,969.09	\$320,335.09	\$426,504.72
TOTAL CHARGE LESS ECA	\$663,699.63	\$654,194.72	\$466,374.61	\$440,469.01	\$471,835.78	\$522,528.58	\$513,077.38	\$503,626.18	\$509,640.58	\$469,150.21	\$427,516.21	\$543,866.15
SUMMARY												
MONTHLY DIFFERENCE	\$103.45	\$97.19	\$65.25	\$65.25	\$77.76	\$77.76	\$77.76	\$77.76	\$77.76	\$65.25	\$65.25	\$107.27
ANNUAL DIFFERENCE		\$98										

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17:34:15 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7670 DENTAL CLINIC
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

RECTANGULAR 14 OTHER 0													
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)													
SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	GLASS (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALL (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	WALL+GLASS (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	GLASS+OPAQUE AREA (SQFT)	AZIMUTH
SPACE 3		0.490	0.490	0.209	39.60	0.209	0.209	0.233	420.40	0.209	0.209	460.00	NORTH
PLENUM 6		0.000	0.000	0.209	0.00	0.209	0.209	0.209	172.50	0.209	0.209	172.50	NORTH
PLENUM 6		0.000	0.000	0.209	0.00	0.209	0.209	0.209	504.00	0.209	0.209	504.00	EAST
SPACE 2		0.490	0.490	0.209	198.00	0.209	0.209	0.251	1146.00	0.209	0.209	1344.00	EAST
PLENUM 6		0.000	0.000	0.209	0.00	0.209	0.209	0.209	172.50	0.209	0.209	172.50	SOUTH
SPACE 4		0.490	0.490	0.209	78.00	0.209	0.209	0.257	382.00	0.209	0.209	460.00	SOUTH
PLENUM 6		0.000	0.000	0.209	0.00	0.209	0.209	0.209	504.00	0.209	0.209	504.00	WEST
SPACE 1		0.490	0.490	0.209	312.00	0.209	0.209	0.274	1032.00	0.209	0.209	1344.00	WEST
SPACE 5		0.000	0.000	0.087	0.00	0.087	0.087	0.087	3795.00	0.087	0.087	3795.00	ROOF
SPACE 1		0.000	0.000	0.087	0.00	0.087	0.087	0.087	2295.00	0.087	0.087	2295.00	ROOF
SPACE 3		0.000	0.000	0.087	0.00	0.087	0.087	0.087	637.50	0.087	0.087	637.50	ROOF
SPACE 2		0.000	0.000	0.087	0.00	0.087	0.087	0.087	2295.00	0.087	0.087	2295.00	ROOF
SPACE 4		0.000	0.000	0.087	0.00	0.087	0.087	0.087	637.50	0.087	0.087	637.50	ROOF
PLENUM 6		0.000	0.000	0.087	0.00	0.087	0.087	0.087	9660.00	0.087	0.087	9660.00	ROOF
SPACE 1		0.000	0.000	0.020	0.00	0.020	0.020	0.020	2295.00	0.020	0.020	2295.00	UNDERGRND
SPACE 2		0.000	0.000	0.020	0.00	0.020	0.020	0.020	2295.00	0.020	0.020	2295.00	UNDERGRND
SPACE 3		0.000	0.000	0.020	0.00	0.020	0.020	0.020	637.50	0.020	0.020	637.50	UNDERGRND
SPACE 4		0.000	0.000	0.020	0.00	0.020	0.020	0.020	637.50	0.020	0.020	637.50	UNDERGRND
SPACE 5		0.000	0.000	0.020	0.00	0.020	0.020	0.020	3795.00	0.020	0.020	3795.00	UNDERGRND

D6-35

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17:34:15 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7670 DENTAL CLINIC
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

RECTANGULAR 14 OTHER 0							
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)							
SURFACE	SPACE	AVERAGE U-VALUE (BTU/HR-SQFT-F)	AVERAGE WALLS+GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH		0.490	0.209	0.227	39.60	592.90	632.50
EAST		0.490	0.209	0.239	198.00	1650.00	1848.00
SOUTH		0.490	0.209	0.244	78.00	554.50	632.50
WEST		0.490	0.209	0.257	312.00	1536.00	1848.00
ROOF		0.000	0.087	0.087	0.00	19320.00	19320.00
ALL WALLS		0.490	0.209	0.245	627.60	4333.40	4961.00
WALLS+ROOFS		0.490	0.109	0.119	627.60	23653.40	24281.00
UNDERGRND		0.000	0.020	0.020	0.00	9660.00	9660.00
BUILDING		0.490	0.083	0.091	627.60	33313.40	33941.00

*** BUILDING ***

FLOOR AREA		9645	SQFT	896	SQMT
VOLUME		106268	CUFT	3010	CUMT
COOLING LOAD					
=====					
TIME		AUG 11	4PM		
DRY-BULB TEMP		100F	38C		
WET-BULB TEMP		71F	22C		
=====					
		HEATING LOAD			
		=====			
		JAN 15	8AM		
		-6F	-21C		
		-7F	-22C		
=====					
		SENSIBLE			
		(KBTU/H)	(KW)		

WALLS		8.794	2.576	0.000	0.000
ROOFS		44.911	13.153	0.000	0.000
GLASS CONDUCTION		7.254	2.124	0.000	0.000
GLASS SOLAR		23.372	6.845	0.000	0.000
DOOR		0.000	0.000	0.000	0.000
INTERNAL SURFACES		0.000	0.000	0.000	0.000
UNDERGROUND SURFACES		-0.914	-0.268	0.000	0.000
OCCUPANTS TO SPACE		7.862	2.303	14.353	4.204
LIGHT TO SPACE		107.528	31.492	0.000	0.000
EQUIPMENT TO SPACE		31.414	9.200	0.000	0.000
PROCESS TO SPACE		0.000	0.000	0.000	0.000
INFILTRATION		0.000	0.000	0.000	0.000

TOTAL		230.221	67.426	14.353	4.204
TOTAL LOAD		244.573	KBTU/H	71.629	KW
TOTAL LOAD / AREA		25.36	BTU/H.SQFT	79.939	W /SQMT

*
* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* LOADS *
* ---- *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17:34:15 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7670 DENTAL CLINIC
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL_DUCT TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-57.426	15	-6. F	-7. F	-218.388	67.457
FEB	0.00000				-39.102	3	-1. F	-2. F	-179.002	67.457
MAR	0.00000				-44.015	6	19. F	18. F	-136.201	67.457
APR	0.00000				-56.338	22	67. F	52. F	-165.788	67.457
MAY	60.03765	16	62. F	59. F	-33.741	13	80. F	66. F	-182.360	67.457
JUN	125.61597	28	90. F	76. F	0.000				0.000	67.457
JUL	142.58212	13	93. F	77. F	0.000				0.000	67.457
AUG	144.29832	23	96. F	77. F	0.000				0.000	67.457
SEP	100.69760	7	93. F	76. F	-51.112	6	67. F	52. F	-157.027	67.457
OCT	1.60873	1	83. F	68. F	-38.996	23	63. F	52. F	-129.139	67.457
NOV	0.00000				-47.896	12	3. F	2. F	-185.054	67.457
DEC	0.00000									
TOTAL	574.841				-368.626				-218.388	67.457
MAX										

D6-37

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17:34:15 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7670 DENTAL CLINIC
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL_DUCT TOPEKA, KS

MONTH	N U M B E R O F H O U R S										--COINCIDENT LOADS--	
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	
JAN	0	744	0	0	744	0	744	0	0	-53.279	21.255	
FEB	0	672	0	0	672	0	672	0	0	-47.569	21.255	
MAR	0	744	0	0	744	0	744	0	0	-59.268	21.255	
APR	0	720	0	0	720	0	720	0	0	-93.275	21.255	
MAY	384	360	0	0	360	384	744	0	0	0.000	21.255	
JUN	720	0	0	0	0	720	720	0	0	0.000	67.457	
JUL	744	0	0	0	0	744	744	0	0	0.000	67.457	
AUG	744	0	0	0	0	744	744	0	0	0.000	67.457	
SEP	720	0	0	0	0	720	720	0	0	0.000	21.255	
OCT	24	720	0	0	720	24	744	0	0	0.000	21.255	
NOV	0	720	0	0	720	0	720	0	0	-58.184	21.255	
DEC	0	744	0	0	744	0	744	0	0	-111.254	21.255	
ANNUAL	3336	5424	0	0	5424	3336	8760	0	0			

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 90.363 235.181 28/10	NATURAL-GAS 91.393 293.361 15/ 8
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	81.563 235.181 25/16	66.359 248.719 3/ 6
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	93.633 235.181 31/16	75.746 198.523 6/ 7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	88.817 235.181 29/16	91.527 233.409 22/18
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	110.498 354.062 16/15	52.689 252.582 13/18
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	132.744 359.126 28/16	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	137.623 366.189 22/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	144.414 372.178 11/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	123.696 362.746 7/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	89.603 235.181 31/16	84.105 223.166 6/18
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	86.815 235.181 30/16	67.485 190.072 23/18
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	90.285 235.181 23/16	79.335 255.675 12/ 6
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	1270.055 372.178	608.638 293.361

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	24.03	608.64
SPACE COOL	187.62	0.00
HVAC AUX	660.84	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.83	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	1270.02	608.64

TOTAL SITE ENERGY 1878.69 MBTU 194.5 KBTU/SQFT-YR GROSS-AREA 194.8 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 4422.62 MBTU 457.8 KBTU/SQFT-YR GROSS-AREA 458.5 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17: 6:24 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION BLDG. 7670 DENTAL CLINIC
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL_DUCT TOPEKA, KS

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	15	7	-7. F	-8. F	-294.778	11324.	67.436
FEB	0.00000				0.000	3	6	-1. F	-2. F	-261.983	10440.	67.436
MAR	0.00000				0.000	14	6	15. F	13. F	-221.552	14416.	67.436
APR	0.00000				0.000	4	6	32. F	31. F	-142.807	15928.	67.436
MAY	29.15188	16	16	68. F	281.222	13	1	69. F	64. F	-98.890	15078.	67.436
JUN	71.47971	28	16	90. F	306.793				0.000	0.000	12730.	67.436
JUL	85.68158	13	16	93. F	321.658				0.000	0.000	11370.	67.436
AUG	89.44794	23	16	96. F	320.574				0.000	0.000	13033.	67.436
SEP	48.54211	7	16	93. F	305.178				0.000	0.000	12106.	67.436
OCT	0.10436	1	18	83. F	27.479	31	6	44. F	39. F	-117.493	15731.	67.436
NOV	0.00000				0.000	3	6	13. F	12. F	-205.326	13236.	67.436
DEC	0.00000				0.000	12	6	3. F	2. F	-258.103	11301.	67.292
TOTAL	324.408				-448.465					-294.778	156697.	67.436
MAX					321.658							

D6-40

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17: 6:24 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION BLDG. 7670 DENTAL CLINIC
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL_DUCT TOPEKA, KS

MONTH	HOURS				HOURS				HOURS				COINCIDENT LOADS--	
	COOLING LOAD	HEATING LOAD	COOL-HEAT LOAD	FLOATING	HEATING AVAIL.	COOLING AVAIL.	FANS ON	VENTING	FANS ON	HEATING LOAD AT PEAK (KBTU/HR)	ELECTRIC LOAD AT PEAK (KW)	COOLING PEAK (KW)	HEATING LOAD AT PEAK (KBTU/HR)	ELECTRIC LOAD AT PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	-119.820	0.978	0.978	-119.820	0.978
FEB	0	672	0	0	672	0	672	0	0	-109.444	0.978	0.978	-109.444	0.978
MAR	0	744	0	0	744	0	744	0	0	-100.393	0.978	0.978	-100.393	0.978
APR	0	720	0	0	720	0	720	0	0	-61.483	3.962	3.962	-61.483	3.962
MAY	291	360	0	93	360	384	744	0	93	0.000	54.735	54.735	0.000	54.735
JUN	626	0	0	29	0	720	744	0	94	0.000	54.158	54.158	0.000	54.158
JUL	715	0	0	29	0	744	744	0	29	0.000	54.824	54.824	0.000	54.824
AUG	705	0	0	39	0	744	744	0	39	0.000	54.776	54.776	0.000	54.776
SEP	483	0	0	237	0	720	744	0	237	0.000	54.155	54.155	0.000	54.155
OCT	8	720	0	16	720	24	744	0	16	0.000	0.978	0.978	0.000	0.978
NOV	0	720	0	0	720	0	720	0	0	-147.855	0.978	0.978	-147.855	0.978
DEC	0	744	0	0	744	0	744	0	0	-183.170	0.978	0.978	-183.170	0.978
ANNUAL	2828	5424	0	508	5424	3336	8760	0	508					

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17: 6:24 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION BLDG. 7670 DENTAL CLINIC
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 43.076 233.308 24/15	NATURAL-GAS 151.156 395.976 15/ 7
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	39.446 233.258 14/16	116.271 359.041 3/ 6
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	52.940 233.854 31/15	98.163 312.458 14/ 6
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	57.215 232.490 22/ 8	58.697 218.401 4/ 6
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	63.175 275.480 31/16	26.467 164.036 13/ 1
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	68.918 287.284 28/16	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	69.555 295.677 13/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	77.397 303.856 11/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	59.121 290.162 7/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	56.124 232.936 20/11	47.272 187.232 31/ 6
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.594 233.030 1/13	86.812 293.436 3/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	42.951 232.694 20/15	138.865 354.621 12/ 6
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	678.511 303.856	723.704 395.976
	ONE YEAR USE/PEAK		

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	26.14	723.70
SPACE COOL	105.21	0.00
HVAC AUX	149.61	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.82	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	678.49	723.70

TOTAL SITE ENERGY 1402.21 MBTU 145.2 KBTU/SQFT-YR GROSS-AREA 145.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2761.27 MBTU 285.8 KBTU/SQFT-YR GROSS-AREA 286.3 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 27.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 7245A ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	989.81	702.46	287.35	287.35
Annual Natural Gas (MBTU)	832.82	1112.07	-279.25	-279.25
Electric Demand June (KW)	80.51	72.64	7.86	7.86
Electric Demand July (KW)	86.00	79.03	6.98	6.98
Electric Demand August (KW)	84.52	77.48	7.04	7.04

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7606A (sq.ft.)	7353.4
ECO Model Bldg 7245A (sq.ft.)	7353.4
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005	
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995	
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohler

1. INVESTMENT: BLDG 7245 - Replace SZs AHUs In Dining area w/ VAV AHUs

A. CONSTRUCTION COST	=	\$29,943
B. SIOH COST	(5.5% of 1A) =	\$1,647
C. DESIGN COST	(6.0% of 1A) =	\$1,797
D. TOTAL COST	(1A + 1B + 1C) =	\$33,387
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$33,387

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	287	\$3,477	15.88	\$55,214
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(279)	(\$1,151)	18.30	(\$21,054)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$381	14.88	\$5,663
F. TOTAL		8	\$2,707		-----> \$39,823

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$0
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST				\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$21,050	5	0.863	\$18,166
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$21,050			\$18,166

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$18,166

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$3,759
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	8.88
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$57,988
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.74

ENGINEER'S OPINION OF PROBABLE COST

PROJECT Fort Riley Feasibility Study for HVAC Upgrade
ENGINEER E M C Engineers, Inc.
Denver, CO

SHEET 1 OF 1
DATE PREPARED 4-May-95
ESTIMATOR C. Wohler
CHECKED BY A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7245								
2		PROPOSED SYSTEM MODIFICATIONS								
3										
4		NEW SYSTEMS INSTALLATION								
5	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	2.0	\$4,433.18	\$8,866	Q-6	40	\$1,608	\$10,475
6	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	\$24.23	\$48	1-ELEC	0.8	\$33	\$82
7	WIRE#12	COPPER WIRING #12	C.L.F.	1.5	\$7.41	\$11	1-ELEC	0.727	\$23	\$34
8	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	60.0	\$2.95	\$177	Q-1	0.2	\$233	\$409
9		FITTINGS ADD 5%				\$9			\$12	\$20
10	INSLPIP1.5	1.25" FIBERGLASS PIPE INSULATION, 1.5" THICK	L.F.	60.0	\$1.40	\$84	Q-14	0.08	\$88	\$172
11	CNTV1	CONTROL VALVE 1"	EA.	2.0	\$190.89	\$382	1-PLUM	0.471	\$20	\$402
12	VSD5	VARIABLE SPEED DRIVE W/ CONTRLER, 5HP	EA.	2.0	\$2,444.79	\$4,890	1-ELEC	21	\$879	\$5,769
13	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	300.0	\$0.47	\$140	Q-10	0.098	\$571	\$711
14	DTINSL1"	DUCT INSULATION, 1" THICK	S.F.	300.0	\$0.48	\$145	Q-14	0.046	\$254	\$399
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		EXISTING SYSTEMS DEMOLITION								
26		AHU DEMO	TON	2.8			Q-5	17.778	\$948	\$948
27										
28										
29										
30										
31		SUBTOTAL				\$14,751			\$4,670	\$19,421
32	OH	OVERHEAD			17%	\$2,478			\$785	\$3,263
33	PRO	PROFIT			10%	\$1,723			\$545	\$2,268
34	CONT	CONTINGENCY			20%	\$3,791			\$1,200	\$4,991
35		TOTAL COST				\$22,743			\$7,200	\$29,943

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT				SHEET 1 OF 1			DATE PREPARED 4-May-95		
ENGINEER				Fort Riley Feasibility Study for HVAC Upgrade			ESTIMATOR C. Wohler		
				E M C Engineers, Inc.			CHECKED BY A. Niemeyer		
				Denver, CO					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST		TOTAL	
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	TOTAL
1		BUILDING 7245							
2		NON-RECURRING							
3									
4		EXISTING SYSTEM REPLACEMENT							
5	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	2.0	\$4,433.18	Q-6	40	\$1,608	\$10,475
6	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	300.0	\$0.47	Q-10	0.098	\$571	\$711
7	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	\$24.23	1-ELEC	0.8	\$33	\$82
8	WIRE#12	COPPER WIRING #12	C.L.F.	1.5	\$7.41	1-ELEC	0.727	\$23	\$34
9	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	60.0	\$2.95	Q-1	0.2	\$233	\$409
10		FITTINGS ADD 5%						\$12	\$20
11	INSLPIP1.5	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	60.0	\$1.40	Q-14	0.08	\$88	\$172
12	CNTV1	CONTROL VALVE 1"	EA.	2.0	\$190.89	1-PLUM	0.471	\$20	\$402
13	DTINSL1"	DUCT INSULATION, 1" THICK	S.F.	300.0	\$0.48	Q-14	0.046	\$254	\$399
14									
15									
16									
17									
18									
19									
20									
21									
22		EXISTING SYSTEMS DEMOLITION							
23		AHU DEMO	TON	2.8		Q-5	17.778	\$948	\$948
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL							\$13,653
32	OH	OVERHEAD			17%			\$3,791	\$2,294
33	PRO	PROFIT			10%			\$637	\$1,595
34	CONT	CONTINGENCY			20%			\$443	\$3,508
35	TOTAL COST							\$974	\$21,050

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET		1		OF		1	
		DATE PREPARED		2-Mar-95					
		ESTIMATOR		C. Wohler					
		CHECKED BY		A. Niemeyer					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST		TOTAL	
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7245							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	-	-	\$0	\$0
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	-	-	\$0	\$0
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	-	-	\$0	\$0

DEMAND LIMITING ANALYSIS BUILDING 7245A

	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
SUMMER PEAK (KW) =	JUL BILL	AUG BILL	SEP BILL	OCT BILL	NOV BILL	DEC BILL	JAN BILL	FEB BILL	MAR BILL	APR BILL	MAY BILL	JUN BILL
27812	7/1-8/2	8/2-9/1	9/3-10/1	10/1-11/1	11/1-12/1	12/1-1/3	1/4-2/1	2/1-3/1	3/3-4/1	4/1-5/3	5/3-6/1	6/1-7/1
ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	6.98	7.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.86
CAPACITY (KW)	32465	34445	26136	20754	26400	22752	27108	25812	23310	21834	21996	30088
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32727	34758	26373	20775	26453	22820	27244	25916	23404	21878	22084	30454
80% SUMMER PEAK (KVA)	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32727	34758	27806	27806	27806	27806	27806	27806	27806	27806	27806	30454
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,113.70	\$138,339.01	\$110,185.21	\$110,185.21	\$110,185.21	\$110,185.21	\$110,185.21	\$110,185.21	\$110,185.21	\$110,185.21	\$110,185.21	\$120,907.00
SUB DISCOUNT \$.20	(\$6,545.37)	(\$6,951.56)	(\$5,561.24)	(\$5,561.24)	(\$5,561.24)	(\$5,561.24)	(\$5,561.24)	(\$5,561.24)	(\$5,561.24)	(\$5,561.24)	(\$5,561.24)	(\$6,090.72)
CAPACITY CHARGE	\$126,158.33	\$133,977.46	\$107,213.97	\$107,213.97	\$107,213.97	\$107,213.97	\$107,213.97	\$107,213.97	\$107,213.97	\$107,213.97	\$107,213.97	\$117,406.28
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,210.06	\$68,194.77	\$54,555.81	\$54,555.81	\$54,555.81	\$54,555.81	\$54,555.81	\$54,555.81	\$54,555.81	\$54,555.81	\$54,555.81	\$59,749.92
100*KVA @ \$.03404	\$111,402.16	\$118,315.49	\$94,652.39	\$94,652.39	\$94,652.39	\$94,652.39	\$94,652.39	\$94,652.39	\$94,652.39	\$94,652.39	\$94,652.39	\$103,663.99
250*KVA @ \$.03084	\$252,323.93	\$267,982.49	\$209,991.60	\$184,086.00	\$214,385.99	\$214,385.99	\$214,385.99	\$214,385.99	\$214,385.99	\$212,767.20	\$171,133.20	\$234,797.10
EXCESS @ \$.02864	\$109,670.13	\$65,782.86	\$0.00	\$0.00	\$1,074.29	\$51,767.09	\$42,315.89	\$32,864.69	\$38,879.09	\$0.00	\$0.00	\$28,312.59
ENERGY CHARGE	\$537,606.28	\$520,275.61	\$359,199.81	\$333,294.21	\$364,668.48	\$415,361.28	\$405,910.08	\$396,458.88	\$402,473.28	\$361,975.41	\$320,341.41	\$426,523.60
TOTAL CHARGE LESS ECA	\$663,764.61	\$654,253.06	\$466,413.77	\$440,508.17	\$471,882.45	\$522,575.25	\$513,124.05	\$503,672.85	\$509,687.25	\$469,189.37	\$427,555.37	\$543,929.88
SUMMARY												
MONTHLY DIFFERENCE	\$38.46	\$38.85	\$26.08	\$26.08	\$31.08	\$31.08	\$31.08	\$31.08	\$31.08	\$26.08	\$26.08	\$43.53
ANNUAL DIFFERENCE.....												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 2/1995 8:26: 5 LDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7245 DINING AREA
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 7 RECTANGULAR 7 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALLS AREA (SQFT)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALLS+GLASS AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)	AZIMUTH
diningarea		1.021	192.00	0.082	0.082	722.78	0.279	914.78	914.78	NORTH-EAST
dining-plm		0.000	0.00	0.082	0.082	690.40	0.082	690.40	690.40	NORTH-EAST
diningarea		1.021	576.00	0.082	0.082	452.20	0.608	1028.20	1028.20	SOUTH-EAST
dining-plm		0.000	0.00	0.082	0.082	776.00	0.082	776.00	776.00	SOUTH-EAST
diningarea		1.021	576.00	0.082	0.082	452.20	0.608	1028.20	1028.20	NORTH-WEST
dining-plm		0.000	0.00	0.082	0.082	776.00	0.082	776.00	776.00	NORTH-WEST
diningarea		0.000	0.00	0.838	0.838	7353.00	0.838	7353.00	7353.00	ROOF
diningarea		0.000	0.00	0.020	0.020	7353.00	0.020	7353.00	7353.00	UNDERGRND

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 2/1995 8:26: 5 LDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7245 DINING AREA
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	1.021	0.082	0.194	192.00	1413.18	1605.18
SOUTH-EAST	1.021	0.082	0.382	576.00	1228.20	1804.20
NORTH-WEST	1.021	0.082	0.382	576.00	1228.20	1804.20
ROOF	0.000	0.838	0.838	0.00	7353.00	7353.00
ALL WALLS	1.021	0.082	0.324	1344.00	3869.58	5213.58
WALLS+ROOFS	1.021	0.577	0.625	1344.00	11222.58	12566.58
UNDERGRND	0.000	0.020	0.020	0.00	7353.00	7353.00
BUILDING	1.021	0.357	0.401	1344.00	18575.58	19919.58

*** BUILDING ***

FLOOR AREA 7353 SQFT 683 SQMT
VOLUME 78436 CUFT 2221 CUMT

COOLING LOAD
=====

TIME JUL 23 7PM
DRY-BULB TEMP 94F 34C
WET-BULB TEMP 78F 26C

HEATING LOAD
=====

JAN 28 4AM
OF -18C
-2F -19C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	2.101	0.615	0.000	0.000	-9.047	-2.650
ROOFS	0.000	0.000	0.000	0.000	0.000	0.000
GLASS CONDUCTION	23.361	6.842	0.000	0.000	-108.011	-31.634
GLASS SOLAR	71.431	20.920	0.000	0.000	2.054	0.601
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.320	-0.387	0.000	0.000	-4.222	-1.237
OCCUPANTS TO SPACE	57.211	16.756	117.843	34.513	4.102	1.202
LIGHT TO SPACE	47.596	13.940	0.000	0.000	8.158	2.389
EQUIPMENT TO SPACE	20.307	5.947	0.000	0.000	1.456	0.426
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	220.687	64.634	117.843	34.513	-105.509	-30.901
TOTAL LOAD	338.530	KBTU/H	99.147	KW	-105.509	KBTU/H
TOTAL LOAD / AREA	46.04	BTU/H.SQFT	145.131	W /SQMT	14.348	BTU/H.SQFT
						W /SQMT

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *

* LOADS *

* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *

* IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 2/1995 8:26: 5 SDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7245 DINING AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL-SZ TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				-138.465	15	3	-8.F	-9.F	17156.	33.166	
FEB	0.00000				-98.040	3	4	0.F	-1.F	15496.	33.166	
MAR	0.00000				-69.278	3	4	16.F	13.F	17156.	33.166	
APR	0.00000				-14.841	5	4	32.F	29.F	16603.	33.166	
MAY	62.13005	31	18	90.F	-2.311	5	4	45.F	41.F	17156.	33.166	
JUN	154.77917	28	18	89.F	0.000				0.000	16603.	33.166	
JUL	194.05418	23	18	95.F	0.000				0.000	17156.	33.166	
AUG	187.13864	21	19	95.F	0.000				0.000	17156.	33.166	
SEP	105.22019	5	18	90.F	0.000				0.000	16603.	33.166	
OCT	2.43536	1	18	83.F	-12.878	20	3	25.F	25.F	17156.	33.166	
NOV	0.00000				-56.612	3	4	13.F	12.F	16603.	33.166	
DEC	0.00000				-121.945	15	2	3.F	2.F	17156.	33.166	
TOTAL	705.758				-514.370					201990.		
MAX									-456.157		33.166	

D7-9

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 2/1995 8:26: 5 SDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7245 DINING AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL-SZ TOPEKA, KS

MONTH	HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS			
-------	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	--	--

MO	UTILITY- TOTAL(MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 65.204 123.379 31/ 7	NATURAL-GAS 212.934 612.756 15/ 3
JAN	TOTAL(MBTU) PEAK (KBTU) DY/HR	65.204 123.379 31/ 7	212.934 612.756 15/ 3
FEB	TOTAL(MBTU) PEAK (KBTU) DY/HR	58.609 123.379 28/ 7	157.700 549.754 3/ 4
MAR	TOTAL(MBTU) PEAK (KBTU) DY/HR	63.128 123.379 31/ 7	115.464 448.528 3/ 4
APR	TOTAL(MBTU) PEAK (KBTU) DY/HR	58.044 123.379 5/ 7	28.567 307.923 5/ 4
MAY	TOTAL(MBTU) PEAK (KBTU) DY/HR	83.517 274.696 31/18	5.462 179.894 5/ 4
JUN	TOTAL(MBTU) PEAK (KBTU) DY/HR	115.606 274.771 28/18	0.000 0.000 30/ 1
JUL	TOTAL(MBTU) PEAK (KBTU) DY/HR	130.490 293.524 23/18	0.000 0.000 31/ 1
AUG	TOTAL(MBTU) PEAK (KBTU) DY/HR	130.454 288.456 21/19	0.000 0.000 31/ 1
SEP	TOTAL(MBTU) PEAK (KBTU) DY/HR	98.418 275.201 6/18	0.000 0.000 30/ 1
OCT	TOTAL(MBTU) PEAK (KBTU) DY/HR	60.807 230.853 1/18	25.493 346.224 20/ 3
NOV	TOTAL(MBTU) PEAK (KBTU) DY/HR	60.494 123.379 30/19	95.322 438.647 3/ 4
DEC	TOTAL(MBTU) PEAK (KBTU) DY/HR	65.021 123.379 31/19	191.874 528.705 15/ 2
ONE YEAR USE/PEAK			832.816 612.756

MONTH	C O O L I N G				H E A T I N G				E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	MAXIMUM ELEC- TRICAL ENERGY (KWH)
JAN	0.00000				-176.577	15	3	-8.F	-531.225	9564.
FEB	0.00000				-128.939	3	4	0.F	-472.075	8675.
MAR	0.00000				-97.346	3	4	16.F	-368.587	10264.
APR	0.00000				-24.256	5	4	32.F	-241.324	13782.
MAY	46.51511	31	18	90.F	-4.302	5	4	45.F	-135.301	13048.
JUN	115.57044	28	18	89.F	0.000				0.000	10158.
JUL	146.65900	23	18	95.F	0.000				0.000	10661.
AUG	144.33791	21	19	95.F	0.000				0.000	10664.
SEP	75.50708	6	18	91.F	0.000				0.000	9779.
OCT	1.62142	1	18	83.F	-23.425	20	3	25.F	-276.908	13934.
NOV	0.00000				-80.243	3	4	13.F	-363.117	10742.
DEC	0.00000				-157.569	15	2	3.F	-450.325	9560.
TOTAL	530.210				-692.657				-531.225	130833.
MAX										33.155

D7-12

MONTH	N U M B E R O F H O U R S										C O I N C I D E N T L O A D S	
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS COINCIDENT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	742	0	0	2	744	0	0	0	2	-230.204	0.905
FEB	0	662	0	0	10	672	0	0	0	10	-231.760	0.905
MAR	0	662	0	0	82	744	0	0	0	82	-223.600	0.905
APR	0	455	0	0	265	720	0	0	0	265	-13.155	10.494
MAY	380	192	0	0	172	744	384	0	0	172	0.000	28.465
JUN	714	0	0	0	6	720	720	0	0	6	0.000	28.750
JUL	744	0	0	0	0	744	744	0	0	0	0.000	29.510
AUG	744	0	0	0	0	744	744	0	0	0	0.000	29.440
SEP	612	0	0	0	108	720	720	0	0	108	0.000	28.764
OCT	17	482	0	0	245	744	24	0	0	245	0.000	24.599
NOV	0	617	0	0	103	720	0	0	0	103	-277.368	0.905
DEC	0	742	0	0	2	744	0	0	0	2	-271.582	0.905
ANNUAL	3211	4554	0	0	995	5424	3336	8760	0	995		

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 40.835 90.187 31/ 7	NATURAL-GAS 269.527 713.594 15/ 3
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	36.755 103.659 26/18	204.942 646.978 3/ 4
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	41.200 114.590 7/19	160.197 527.115 3/ 4
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	49.121 114.365 3/19	44.838 373.939 5/ 4
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	64.394 245.846 31/18	9.250 241.462 5/ 4
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	81.558 247.935 28/19	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	94.585 269.717 23/18	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	95.336 264.432 21/19	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	65.677 248.220 6/18	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	50.466 174.332 1/18	44.248 417.411 20/ 3
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	41.896 113.933 7/19	133.389 520.663 3/ 4
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	40.646 90.187 31/19	245.676 622.136 15/ 2
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	702.468 269.717	1112.067 713.594

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 6/1995 12: 5:16 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7245 DINING AREA
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	39.34	1112.07
SPACE COOL	216.41	0.00
HVAC AUX	89.46	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	283.97	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	73.28	0.00
TOTAL	702.46	1112.07

TOTAL SITE ENERGY 1814.53 MBTU 246.8 KBTU/SQFT-YR GROSS-AREA 246.8 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 3221.58 MBTU 438.1 KBTU/SQFT-YR GROSS-AREA 438.1 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 13.7
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 7245B
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1011.71	908.39	103.32	103.32
Annual Natural Gas (MBTU)	4317.23	806.35	3510.88	3510.88
Electric Demand June (KW)	50.44	44.27	6.16	6.16
Electric Demand July (KW)	49.07	44.06	5.01	5.01
Electric Demand August (KW)	50.44	44.06	6.37	6.37

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7606B (sq.ft.)	3954.4
ECO Model Bldg 7245B (sq.ft.)	3954.4
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 7245 - Replace Kitchen MAUs & Exhaust w/ Heat Recovery Units

A. CONSTRUCTION COST	=	\$81,017
B. SIOH COST	(5.5% of 1A) =	\$4,456
C. DESIGN COST	(6.0% of 1A) =	\$4,861
D. TOTAL COST	(1A + 1B + 1C) =	\$90,334
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$90,334

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	JAN '95 DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	103	\$1,250	15.88	\$19,853
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	3,511	\$14,465	18.30	\$264,706
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$332	14.88	\$4,942
F. TOTAL		3,614	\$16,047		-----> \$289,501

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	\$0	14.88	\$0
2		\$0	14.88	\$0
3		\$0	14.88	\$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST (-)	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$30,377	5	0.863	\$26,215
b.				\$0
c.				\$0
d. TOTAL	\$30,377			\$26,215

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = \$26,215

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bd1/Economic Life))	\$17,566
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	5.14
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$315,716
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	3.49

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF	1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95		
						ESTIMATOR		C. Wohler		
						CHECKED BY		A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL	
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit		Total
1		BUILDING 7245								
2		PROPOSED SYSTEM MODIFICATIONS								
3										
4		NEW SYSTEMS INSTALLATION								
5	KHRU9C	KITCHEN HEAT RECOVERY UNIT, 19,000 CFM	EA.	1.0	\$28,294.80	\$28,295	Q-6	40	\$804	\$29,099
6	KHRU5	KITCHEN HEAT RECOVERY UNIT, 8,500 CFM	EA.	1.0	\$17,442.00	\$17,442	Q-6	32	\$643	\$18,085
7	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	950.0	\$0.47	\$442	Q-10	0.094	\$1,735	\$2,177
8	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	50.0	\$3.91	\$196	Q-1	0.25	\$242	\$438
9		FITTINGS, 5%				\$10			\$12	\$22
10	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	50.0	\$1.46	\$73	Q-14	0.084	\$77	\$151
11	DTINS1.2"	DUCT INSULATION, 2" THICK	S.F.	700.0	\$0.83	\$583	Q-14	0.053	\$683	\$1,267
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23		EXISTING SYSTEM DEMOLITION								
24		AHU DEMOLITION	TON	3.6			Q-5	17.778	\$1,241	\$1,241
25		DUCT DEMOLITION	TON	0.2			Q-5	17.778	\$69	\$69
26										
27										
28										
29										
30										
31		SUBTOTAL				\$47,041			\$5,508	\$52,548
32	OH	OVERHEAD			17%	\$7,903			\$925	\$8,828
33	PRO	PROFIT			10%	\$5,494			\$643	\$6,138
34	CONT	CONTINGENCY			20%	\$12,088			\$1,415	\$13,503
35	TOTAL COST					\$72,525			\$8,491	\$81,017

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade			SHEET		1		OF
ENGINEER		E M C Engineers, Inc. Denver, CO			DATE PREPARED		4-May-95		
					ESTIMATOR		C. Wohler		
					CHECKED BY		A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7245							
2		NON-RECURRING							
3		NEW SYSTEMS INSTALLATION							
4									
5	AHU12000	12,000 CFM AHU, HEATING ONLY	EA.	1.0	\$5,499.08	Q-6	52.174	\$1,049	\$6,548
6	AHU3200	3,200 CFM AHU, HEATING ONLY	EA.	1.0	\$2,519.40	Q-5	20	\$388	\$2,907
7	AHU1300	1,300 CFM AHU, HEATING ONLY	EA.	1.0	\$1,913.78	Q-5	13.33	\$258	\$2,172
8	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	90.0	\$2.95	Q-1	0.2	\$349	\$614
9		FITTINGS, 5%			\$13			\$17	\$31
10	CNTV1.5	CONTROL VALVE 1-1/2"	EA.	3.0	\$276.17	1-PLUM	0.727	\$47	\$875
11	INSLPIP1.5	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90.0	\$1.40	Q-14	0.08	\$133	\$258
12	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	450.0	\$0.47	Q-10	0.094	\$822	\$1,031
13	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	700.0	\$0.83	Q-14	0.053	\$683	\$1,267
14	EXHOD1.3	ROOF EXHAUSTER, 1,300 CFM	EA.	1.0	\$479.66	Q-20	4	\$77	\$556
15	EXHOD11	ROOF EXHAUSTER, 11,000 CFM	EA.	1.0	\$1,986.45	Q-20	10	\$192	\$2,178
16	EXHOD3.6	ROOF EXHAUSTER, 3,600 CFM	EA.	1.0	\$823.65	Q-20	5	\$96	\$920
17									
18									
19									
20									
21									
22		EXISTING SYSTEM DEMOLITION							
23		AHU DEMOLITION	TON	1.0		Q-5	17.778	\$345	\$345
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL			\$15,247			\$4,455	\$19,703
32	OH	OVERHEAD			17%			\$749	\$3,310
33	PRO	PROFIT			10%			\$520	\$2,301
34	CONT	CONTINGENCY			20%			\$1,145	\$5,063
35	TOTAL COST				\$23,507			\$6,869	\$30,377

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1		
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED				1-Mar-95	
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR				C. Wohler	
										CHECKED BY				A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL					
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total						
1		BUILDING 7245													
2		ANNUAL RECURRING													
3		ANNUAL MAINTENANCE COST - BASELINE													
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	\$0		-		\$0				\$0		
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT													
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	\$0		-		\$0				\$0		
30															
31															
32															
33															
34															
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	\$0		-		\$0				\$0		

DEMAND LIMITING ANALYSIS BUILDING 7245B

	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
SUMMER PEAK (KW) = 27812												
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)												
50*KVA @ \$.03924	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
100*KVA @ \$.03404	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
250*KVA @ \$.03084	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
EXCESS @ \$.02864	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)												
CAPACITY (KW)	5.01	6.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.16
POWER FACTOR (%)	32467	34446	26136	20754	26400	22752	27108	25812	23310	21834	21996	30090
CAPACITY (KVA)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
80% SUMMER PEAK (KVA)	32729	34758	26373	20775	26453	22820	27244	25916	23404	21878	22084	30455
CONTRACT MINIMUM (KVA)	27807	27807	27807	27807	27807	27807	27807	27807	27807	27807	27807	27807
BILLING CAPACITY (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,121.72	\$138,341.74	\$110,187.39	\$110,187.39	\$110,187.39	\$110,187.39	\$110,187.39	\$110,187.39	\$110,187.39	\$110,187.39	\$110,187.39	\$120,913.96
SUB DISCOUNT \$.20	(\$6,545.76)	(\$6,951.69)	(\$5,561.35)	(\$5,561.35)	(\$5,561.35)	(\$5,561.35)	(\$5,561.35)	(\$5,561.35)	(\$5,561.35)	(\$5,561.35)	(\$5,561.35)	(\$6,091.06)
CAPACITY CHARGE	\$126,165.95	\$133,980.04	\$107,216.04	\$107,216.04	\$107,216.04	\$107,216.04	\$107,216.04	\$107,216.04	\$107,216.04	\$107,216.04	\$107,216.04	\$117,412.90
TOTAL ENERGY (KWH)												
50*KVA @ \$.03924	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
100*KVA @ \$.03404	\$64,213.94	\$68,196.08	\$54,556.87	\$54,556.87	\$54,556.87	\$54,556.87	\$54,556.87	\$54,556.87	\$54,556.87	\$54,556.87	\$54,556.87	\$59,753.30
250*KVA @ \$.03084	\$111,408.90	\$118,317.77	\$94,654.22	\$94,654.22	\$94,654.22	\$94,654.22	\$94,654.22	\$94,654.22	\$94,654.22	\$94,654.22	\$94,654.22	\$103,669.84
EXCESS @ \$.02864	\$252,339.19	\$267,987.67	\$209,989.12	\$184,083.52	\$214,390.14	\$214,390.14	\$214,390.14	\$214,390.14	\$214,390.14	\$212,764.72	\$171,130.72	\$234,810.36
ENERGY CHARGE	\$537,609.49	\$520,276.69	\$359,200.20	\$333,294.60	\$364,669.36	\$415,362.16	\$405,910.96	\$396,459.76	\$402,474.16	\$361,975.80	\$320,341.80	\$426,526.39
TOTAL CHARGE LESS ECA	\$663,775.44	\$654,256.74	\$466,416.24	\$440,510.64	\$471,885.39	\$522,578.19	\$513,126.99	\$503,675.79	\$509,690.19	\$469,191.84	\$427,557.84	\$543,939.29
SUMMARY												
MONTHLY DIFFERENCE	\$27.64	\$35.18	\$23.61	\$23.61	\$28.14	\$28.14	\$28.14	\$28.14	\$28.14	\$23.61	\$23.61	\$34.13
ANNUAL DIFFERENCE.....		\$332.10										

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17: 7: 5 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BUILDING 7245 KITCHEN AREA
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 7 RECTANGULAR 7 OTHER 0
 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALL + GLASS AREA (SQFT)	AZIMUTH
KITCHEN		1.021	42.40	0.082	371.00	0.178	413.40	SOUTH-EAST
KIT-MEZZIN		0.000	0.00	0.082	351.00	0.082	351.00	SOUTH-EAST
KIT-MEZZIN		0.000	0.00	0.082	776.70	0.082	776.70	SOUTH-WEST
KITCHEN		1.021	115.20	0.082	799.58	0.200	914.78	SOUTH-WEST
KITCHEN		1.021	16.00	0.082	397.40	0.118	413.40	NORTH-WEST
KIT-MEZZIN		0.000	0.00	0.082	351.00	0.082	351.00	NORTH-WEST
KIT-MEZZIN		0.000	0.00	0.077	3960.00	0.077	3960.00	ROOF
KITCHEN		0.000	0.00	0.020	3960.00	0.020	3960.00	UNDERGRND

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17: 7: 5 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BUILDING 7245 KITCHEN AREA
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
SOUTH-EAST	1.021	0.082	0.134	42.40	722.00	764.40
SOUTH-WEST	1.021	0.082	0.146	115.20	1576.28	1691.48
NORTH-WEST	1.021	0.082	0.101	16.00	748.40	764.40
ROOF	0.000	0.077	0.077	0.00	3960.00	3960.00
ALL WALLS	1.021	0.082	0.132	173.60	3046.68	3220.28
WALLS+ROOFS	1.021	0.079	0.102	173.60	7006.68	7180.28
UNDERGRND	0.000	0.020	0.020	0.00	3960.00	3960.00
BUILDING	1.021	0.058	0.073	173.60	10966.68	11140.28

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17: 7: 5 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BUILDING 7245 KITCHEN AREA
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 3954 SQFT 367 SQMT
VOLUME 41917 CUFT 1187 CUMT

COOLING LOAD HEATING LOAD
AUG 24 6PM JAN 28 4AM
93F 34C OF -18C
76F 24C -2F -19C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	1.904	0.558	0.000	0.000	-8.554	-2.505
ROOFS	0.000	0.000	0.000	0.000	0.000	0.000
GLASS CONDUCTION	3.276	0.960	0.000	0.000	-13.951	-4.086
GLASS SOLAR	14.150	4.144	0.000	0.000	0.282	0.082
DOOR	0.019	0.005	0.000	0.000	-0.040	-0.012
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.375	-0.110	0.000	0.000	-2.274	-0.666
OCCUPANTS TO SPACE	7.218	2.114	12.500	3.661	0.771	0.226
LIGHT TO SPACE	8.504	2.491	0.000	0.000	3.254	0.953
EQUIPMENT TO SPACE	72.879	21.344	0.000	0.000	7.136	2.090
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	107.575	31.506	12.500	3.661	-13.376	-3.918
TOTAL LOAD	120.075 KBTU/H	35.167 KW			-13.376 KBTU/H	-3.918 KW
TOTAL LOAD / AREA	30.37BTU/H.SQFT	95.725 W /SQMT			3.383BTU/H.SQFT	10.664 W /SQMT

*
* NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR
*
* LOADS
*
* 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION
*
* IN CONSIDERATION
*

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/ 8/1995 17: 7: 5 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BUILDING 7245 KITCHEN AREA
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR KIT H&VS TOPEKA, KS

MONTH	COOLING				HEATING				ELECTRIC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	TRICAL ENERGY (KWH)	ELEC LOAD (KW)	MAXIMUM
JAN	0.00000				-558.169	15	3	-8.F	-1095.280	21944.	43.289	43.289
FEB	0.00000				-466.424	3	7	-5.F	-1040.075	19821.	43.289	43.289
MAR	0.00000				-407.669	4	4	14.F	-939.315	21944.	43.289	43.289
APR	0.00000				-185.857	5	7	30.F	-745.109	21236.	43.289	43.289
MAY	0.00000				-94.246	1	6	37.F	-606.853	21944.	43.289	43.289
JUN	0.00000				-30.668	2	7	50.F	-370.723	21236.	43.289	43.289
JUL	0.00000				-9.397	29	7	59.F	-212.567	21944.	43.289	43.289
AUG	0.00000				-12.899	4	7	54.F	-298.524	21944.	43.289	43.289
SEP	0.00000				-87.143	11	7	40.F	-559.145	21236.	43.289	43.289
OCT	0.00000				-181.693	20	8	23.F	-886.345	21944.	43.289	43.289
NOV	0.00000				-346.989	2	24	15.F	-939.312	21236.	43.289	43.289
DEC	0.00000				-534.212	11	22	15.F	-944.996	21944.	43.289	43.289
TOTAL	0.000				-2915.363				-1095.280	258360.		43.289
MAX												

D7-23

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/ 8/1995 17: 7: 5 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BUILDING 7245 KITCHEN AREA
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR KIT H&VS TOPEKA, KS

MONTH	COOLING				HEATING				ELECTRIC			
	COOLING LOAD	HEATING LOAD	COOL-HEAT LOAD	COINCIDENT LOAD	COOLING AVAIL.	HEATING AVAIL.	FANS ON CYCLE ON	NIGHT VENTING	FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK	ELECTRIC LOAD AT COOLING PEAK	MAXIMUM
JAN	0	744	0	0	0	744	0	0	0	-703.653	23.485	23.485
FEB	0	672	0	0	0	672	0	0	0	-720.720	23.485	23.485
MAR	0	744	0	0	0	744	0	0	0	-701.250	23.485	23.485
APR	0	663	0	0	57	720	0	0	57	-388.244	16.222	16.222
MAY	0	508	0	0	236	744	0	0	236	-158.677	16.222	16.222
JUN	0	289	0	0	431	720	0	0	431	0.000	16.222	16.222
JUL	0	148	0	0	596	744	0	0	596	-26.091	16.222	16.222
AUG	0	159	0	0	585	744	0	0	585	0.000	16.222	16.222
SEP	0	421	0	0	299	720	0	0	299	-406.486	16.222	16.222
OCT	0	652	0	0	92	744	0	0	92	-528.265	23.485	23.485
NOV	0	708	0	0	12	720	0	0	12	-826.303	23.485	23.485
DEC	0	744	0	0	0	744	0	0	0	-777.474	23.485	23.485
ANNUAL	0	6452	0	0	2308	8760	0	0	2308			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/ 8/1995 17: 7: 5 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BUILDING 7245 KITCHEN AREA
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY -	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	93.032	779.680
JAN	PEAK(KBTU)	172.143	1438.102
	DY/HR	31/18	15/ 3
	TOTAL(MBTU)	84.000	660.615
FEB	PEAK(KBTU)	172.143	1377.675
	DY/HR	28/18	3/ 7
	TOTAL(MBTU)	92.337	598.309
MAR	PEAK(KBTU)	172.143	1265.917
	DY/HR	31/18	4/ 4
	TOTAL(MBTU)	84.544	301.045
APR	PEAK(KBTU)	172.143	1045.171
	DY/HR	30/ 7	5/ 7
	TOTAL(MBTU)	82.762	164.558
MAY	PEAK(KBTU)	172.143	883.734
	DY/HR	28/ 7	1/ 6
	TOTAL(MBTU)	75.418	57.134
JUN	PEAK(KBTU)	172.143	599.770
	DY/HR	12/ 7	2/ 7
	TOTAL(MBTU)	75.896	18.725
JUL	PEAK(KBTU)	167.476	379.872
	DY/HR	29/ 7	29/ 7
	TOTAL(MBTU)	76.205	24.830
AUG	PEAK(KBTU)	172.143	510.869
	DY/HR	4/ 7	4/ 7
	TOTAL(MBTU)	79.157	148.335
SEP	PEAK(KBTU)	172.143	827.201
	DY/HR	30/18	11/ 7
	TOTAL(MBTU)	87.179	297.240
OCT	PEAK(KBTU)	172.143	1206.406
	DY/HR	31/18	20/ 8
	TOTAL(MBTU)	88.116	515.101
NOV	PEAK(KBTU)	172.143	1265.913
	DY/HR	30/18	2/24
	TOTAL(MBTU)	93.024	751.656
DEC	PEAK(KBTU)	172.143	1272.269
	DY/HR	31/18	11/22
	ONE YEAR	1011.671	4317.231
	USE/PEAK	172.143	1438.102

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17: 7: 5 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BUILDING 7245 KITCHEN AREA
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	129.47	4317.23
SPACE COOL	0.00	0.00
HVAC AUX	367.52	0.00
DOM HCT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	65.32	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	449.40	0.00
TOTAL	1011.71	4317.23

TOTAL SITE ENERGY 5328.90 MBTU 1345.7 KBTU/SQFT-YR GROSS-AREA 1347.6 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 7355.28 MBTU 1857.4 KBTU/SQFT-YR GROSS-AREA 1860.0 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 4.9
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17:15:53 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BUILDING 7245 KITCHEN AREA
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR KIT_HAVS TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM HEATING LOAD	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000			0.000	-122.144	16	10	19.F 16.F	21944.	-294.581	21944.	43.289
FEB	0.00000			0.000	-96.293	3	11	16.F 13.F	19821.	-277.715	19821.	43.289
MAR	0.00000			0.000	-74.915	3	4	16.F 13.F	21944.	-246.204	21944.	43.289
APR	0.00000			0.000	-24.267	5	4	32.F 29.F	21236.	-165.388	21236.	43.289
MAY	0.00000			0.000	-7.285	1	4	39.F 37.F	21944.	-116.566	21944.	43.289
JUN	0.00000			0.000	-2.499	23	4	67.F 66.F	21236.	-75.891	21236.	43.289
JUL	0.00000			0.000	-1.333	4	4	68.F 65.F	21944.	-59.244	21944.	43.289
AUG	0.00000			0.000	-0.844	26	10	69.F 67.F	21944.	-42.436	21944.	43.289
SEP	0.00000			0.000	-8.166	11	4	43.F 42.F	21236.	-91.949	21236.	43.289
OCT	0.00000			0.000	-20.983	20	4	25.F 25.F	21944.	-197.680	21944.	43.289
NOV	0.00000			0.000	-60.738	2	4	17.F 15.F	21236.	-240.878	21236.	43.289
DEC	0.00000			0.000	-113.182	15	9	16.F 14.F	21944.	-273.544	21944.	43.289
TOTAL	0.000			0.000	-532.649				258360.	-294.581		43.289
MAX												

D7-26

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17:15:53 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BUILDING 7245 KITCHEN AREA
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR KIT_HAVS TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING LOAD	COINCIDENT COOL-HEAT LOAD	FLOATING LOAD	AVAIL.	COOLING AVAIL.	HEATING AVAIL.	FANS ON CYCLE	VENTING FANS ON	COOLING PEAK (KBTU/HR)	HEATING PEAK (KBTU/HR)	COOLING PEAK (KW)	HEATING PEAK (KW)
JAN	0	0	0	744	0	744	0	0	-152.729	23.485	23.485	23.485
FEB	0	0	3	672	0	672	0	0	-156.009	23.485	23.485	23.485
MAR	0	0	55	744	0	744	0	0	-149.142	23.485	23.485	23.485
APR	0	0	301	720	0	720	0	0	-58.487	16.222	16.222	16.222
MAY	0	0	526	744	0	744	0	0	0.000	16.222	16.222	16.222
JUN	0	0	615	720	0	720	0	0	0.000	16.222	16.222	16.222
JUL	0	0	692	744	0	744	0	0	-26.091	16.222	16.222	16.222
AUG	0	0	698	744	0	744	0	0	0.000	16.222	16.222	16.222
SEP	0	0	487	720	0	720	0	0	-68.662	16.222	16.222	16.222
OCT	0	0	314	744	0	744	0	0	-97.472	23.485	23.485	23.485
NOV	0	0	129	720	0	720	0	0	-183.677	23.485	23.485	23.485
DEC	0	0	0	744	0	744	0	0	-176.343	23.485	23.485	23.485
ANNUAL	0	0	3820	8760	0	8760	0	0				

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY 79.674 154.352 31/18	NATURAL-GAS 176.135 386.785 16/10
JAN	TOTAL(MBTU) PEAK(KBTU) DY/HR	71.862 154.352 28/12	142.049 368.311 3/11
FEB	TOTAL(MBTU) PEAK(KBTU) DY/HR	78.796 154.352 31/12	114.596 333.269 3/ 4
MAR	TOTAL(MBTU) PEAK(KBTU) DY/HR	74.286 154.352 24/ 7	40.820 240.247 5/ 4
APR	TOTAL(MBTU) PEAK(KBTU) DY/HR	75.600 154.352 6/ 5	13.342 181.858 1/ 4
MAY	TOTAL(MBTU) PEAK(KBTU) DY/HR	72.756 151.106 2/ 5	4.769 131.949 23/ 4
JUN	TOTAL(MBTU) PEAK(KBTU) DY/HR	75.058 150.371 28/ 5	2.525 105.691 4/ 4
JUL	TOTAL(MBTU) PEAK(KBTU) DY/HR	75.013 150.392 27/ 5	1.665 77.127 26/10
AUG	TOTAL(MBTU) PEAK(KBTU) DY/HR	73.280 154.352 11/ 7	15.001 151.789 11/ 4
SEP	TOTAL(MBTU) PEAK(KBTU) DY/HR	76.663 154.352 27/ 7	36.615 277.960 20/ 4
OCT	TOTAL(MBTU) PEAK(KBTU) DY/HR	75.797 154.352 30/18	93.941 327.277 2/ 4
NOV	TOTAL(MBTU) PEAK(KBTU) DY/HR	79.562 154.352 31/18	164.888 363.713 15/ 9
DEC	TOTAL(MBTU) PEAK(KBTU) DY/HR		
ONE YEAR	908.349		806.346
USE/PEAK	154.352		386.785

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17:15:53 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BUILDING 7245 KITCHEN AREA
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE			
IN SITE MBTU -			
CATEGORY OF USE	ELECTRICITY	NATURAL-GAS	
SPACE HEAT	26.15	806.35	
SPACE COOL	0.00	0.00	
HVAC AUX	367.52	0.00	
DOM HOT WTR	0.00	0.00	
AUX SOLAR	0.00	0.00	
LIGHTS	65.32	0.00	
VERT TRANS	0.00	0.00	
MISC EQUIP	449.40	0.00	
TOTAL	908.39	806.35	

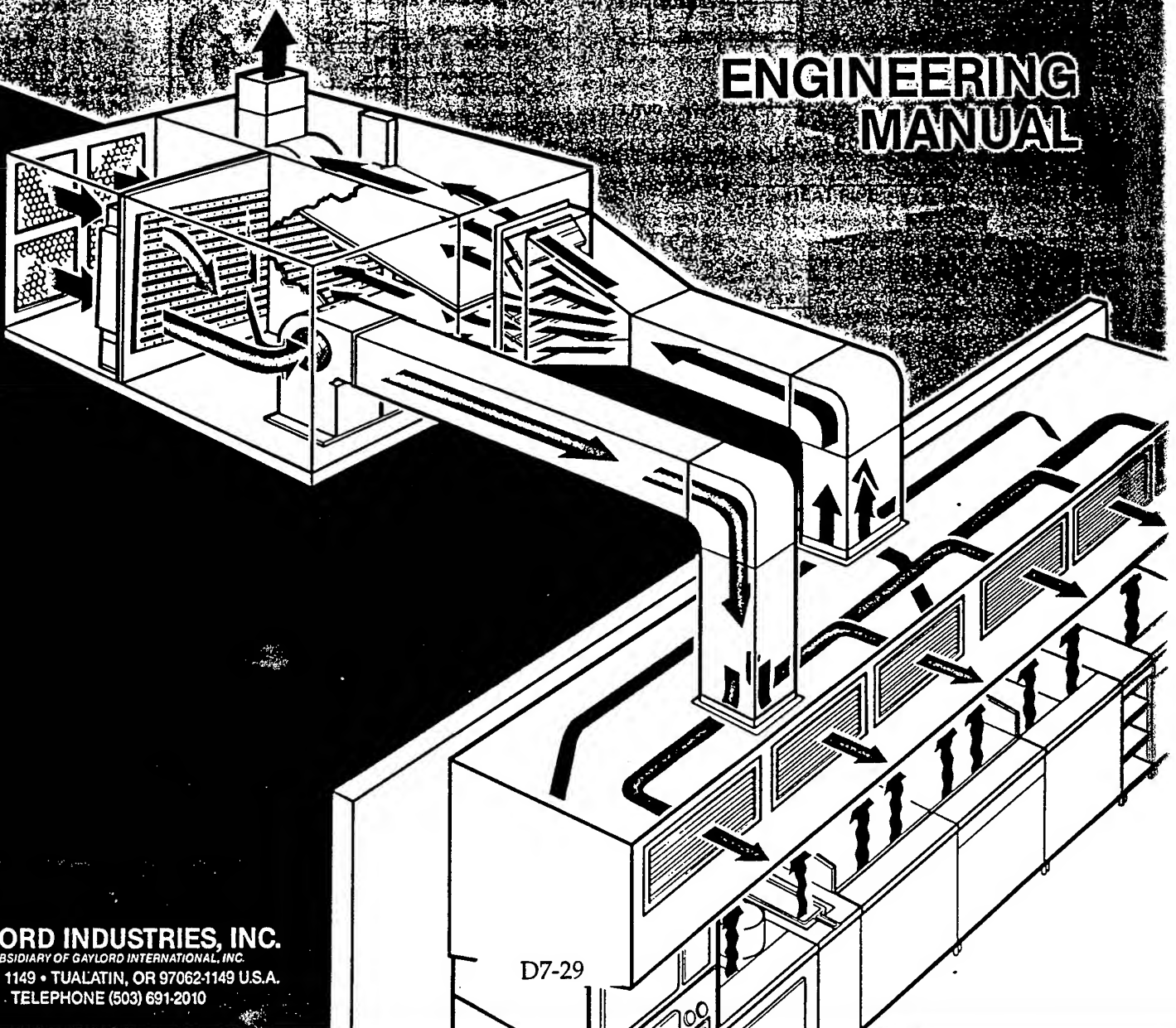
TOTAL SITE ENERGY 1714.69 MBTU 433.0 KBTU/SQFT-YR GROSS-AREA 433.6 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 3534.12 MBTU 892.5 KBTU/SQFT-YR GROSS-AREA 893.7 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 3.3
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

The
GAYLORD

HRU

Heat Reclaim Unit

**ENGINEERING
MANUAL**



GAYLORD INDUSTRIES, INC.

A SUBSIDIARY OF GAYLORD INTERNATIONAL, INC.

P.O. BOX 1149 • TUALATIN, OR 97062-1149 U.S.A.

TELEPHONE (503) 691-2010

D7-29

CONTROL CABINET PIPE SIZE

Pipe size to and from the control cabinet is determined by adding the water consumption of the water-wash ventilator to the HRU water consumption. The average water consumption for a Gaylord water-wash ventilator is one GPM per lineal ft. of ventilator and the water consumption for the HRU is shown on the following engineering charts. Once the total GPM has been calculated, refer to the pipe size chart below for the correct control cabinet pipe size. The final pipe size to the HRU is also shown on the engineering charts.

NOTE: If the HRU is used in conjunction with a non-water-wash ventilator, then the control cabinet pipe size would be the same as the HRU pipe size.

CONTROL CABINET PIPE SIZE CHART					
MAX GPM	5	10	20	35	50
REQ'D PIPE SIZE	1/2"	3/4"	1"	1 1/4"	1 1/2"

GLOSSARY OF TERMS

- CFM Cubic Feet per Minute (Air Volume)
- BTU (British Thermal Unit) The amount of heat required to raise the temperature of one lb. of water by one degree F.
- KWH (Kilowatt Hour) 1000 watts for one hour. Also equals 3412 BTU per hour.
- 1.08 Conversion factor relating to CFM, temperature rise and BTU.
- ΔT (Delta T) Temperature difference between the incoming supply air and the exhaust air. Example: If the incoming air temperature is + 10°F, and the exhaust is 110°F, $\Delta T = 100^\circ F$.
- SRF (Supply Recovery Factor) The efficiency of the Heat Reclaim Coil. Supply recovery factors are derived from performance curves provided by QDT, Ltd. Example: An HRU operating at .65 SRF and 100°F ΔT , the supply temperature would increase by 65° (.65 SRF \times 100° $\Delta T = 65^\circ$)

Engineering Charts

The following engineering charts are used to determine the frame size, exhaust and supply fan wheel size and motor H.P., supply recovery factor, and plumbing data. A step by step method of how to use the charts is described on page 3. Once the frame size has been selected, the exact size and location of the duct collars can be determined by using the drawings and the dimension chart on pages 13 and 14.

NOTE: Capacities and sizes shown are for standard units only. For capacities and sizes not listed please consult factory.

<div>HRU FRAME SIZE - 1</div> <div>TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY) 2500 TO 3500 CFM</div> <div>OVERALL SIZE</div> <div>LENGTH: 8'-0"</div> <div>WIDTH: 6'-0"</div> <div>HEIGHT: 4'-0"</div> <div>DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR</div> <div>WEIGHT: 1700 LBS.</div> <div>COIL DATA</div> <div>SIZE: 24" x 48"</div> <div>FACE AREA: 8 SQ. FT.</div> <div>RANGE: 370-520 FPM</div> <div>PLUMBING REQUIREMENTS</div> <div>H.W. REQ'D - 140° MIN. 180° MAX.</div> <div>WATER PRESS. - 40 PSI MIN. 80 PSI MAX.</div> <div>AVERAGE WASH CYCLE BETWEEN 5 - 7 MIN.</div>	SUPPLY TO EXHAUST RATIO		80%						90%						100%					
	EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	1400		1650		1900		1300		1600		1850		1250		1500		1750	
		EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
		1.5"	13	1.0	13	1.0	13	1.5	12	1.0	12	1.0	13	1.5	12	1.0	12	1.0	13	1.5
		2.0"	13	1.5	13	1.5	13	2.0	12	1.0	12	1.5	13	2.0	12	1.0	12	1.5	13	1.5
	2.5"	12	1.5	12	1.5	13	2.0	12	1.5	12	1.5	13	2.0	12	1.5	12	1.5	13	2.0	
	SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	1100		1300		1500		1150		1450		1650		1250		1500		1750	
		EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
		0.5"	8	.75	8	1.0	9	1.0	8	1.0	9	1.0	9	1.0	8	1.0	9	1.0	9	1.5
		0.75"	8	.75	8	1.0	9	1.0	8	1.0	9	1.0	9	1.0	8	1.0	9	1.0	9	1.5
1.0"	8	1.0	9	1.0	9	1.0	8	1.0	9	1.0	9	1.0	8	1.0	9	1.0	9	1.5		
PLUMBING DATA	SUPPLY RECOVERY FACTOR	.67		.64		.63		.64		.61		.58		.62		.58		.56		
	GPM@40 PSI	2.5						3.0						3.0						
	H.W. SIZE	1/2"						1/2"						1/2"						
	DRAIN SIZE	1 1/2"						1 1/2"						1 1/2"						

HRU FRAME SIZE - 2

TOTAL AIR CAPACITY
RANGE (COMBINED
EXHAUST AND SUPPLY)
3500 TO 5000 CFM
OVERALL SIZE

LENGTH: 9'-0"

WIDTH: 6'-0"

HEIGHT: 4'-9"

DOES NOT INCLUDE EXHAUST
OUTLET DUCT COLLAR
WEIGHT: 2400 LBS.

COIL DATA

SIZE: 30" x 48"

FACE AREA: 10 SQ. FT.

RANGE: 390-560 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D - 140° MIN.
180° MAX.

WATER PRESS. - 40 PSI MIN.
80 PSI MAX.

AVERAGE WASH CYCLE
BETWEEN 5 - 7 MIN.

SUPPLY TO EXHAUST RATIO		80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	2000		2400		2750		1900		2300		2650		1800		2150		2500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.		
	1.5"	13	1.5	15	2.0	15	3.0	13	1.5	15	2.0	15	3.0	13	1.5	15	1.5	15	2.0
	2.0"	13	1.5	15	2.0	15	3.0	13	1.5	15	2.0	15	3.0	13	1.5	15	2.0	15	3.0
	2.5"	15	2.0	15	2.0	15	3.0	15	2.0	15	2.0	15	3.0	13	1.5	15	2.0	15	3.0
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	1600		1900		2200		1700		2100		2400		1800		2150		2500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.		
	0.5"	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	1.5
	0.75"	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	2.0
	1.0"	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	2.0
SUPPLY RECOVERY FACTOR		.66		.63		.62		.62		.59		.57		.59		.57		.54	
PLUMBING DATA	GPM @40 PSI	4						3.5						3					
	H.W. SIZE	1/2"						1/2"						1/2"					
	DRAIN SIZE	1 1/2"						1 1/2"						1 1/2"					

HRU FRAME SIZE - 3

TOTAL AIR CAPACITY
RANGE (COMBINED
EXHAUST AND SUPPLY)
5000 TO 6000 CFM
OVERALL SIZE

LENGTH: 9'-0"

WIDTH: 6'-0"

HEIGHT: 5'-6"

DOES NOT INCLUDE EXHAUST
OUTLET DUCT COLLAR
WEIGHT: 2500 LBS.

COIL DATA

SIZE: 36" x 48"

FACE AREA: 12 SQ. FT.

RANGE: 440-530 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D - 140° MIN.
180° MAX.

WATER PRESS. - 40 PSI MIN.
80 PSI MAX.

AVERAGE WASH CYCLE
BETWEEN 5 - 7 MIN.

SUPPLY TO EXHAUST RATIO		80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	2750		3000		3300		2650		2900		3200		2500		2750		3000	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.		
	1.5"	15	2.0	18	2.0	18	3.0	15	2.0	18	2.0	18	3.0	15	2.0	15	2.0	18	3.0
	2.0"	15	3.0	18	3.0	18	3.0	15	3.0	18	3.0	18	3.0	15	2.0	15	3.0	18	3.0
	2.5"	15	3.0	18	3.0	18	5.0	15	3.0	18	3.0	18	3.0	15	3.0	15	3.0	18	3.0
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	2200		2400		2650		2400		2600		2900		2500		2750		3000	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.		
	0.5"	9	1.5	11	1.5	11	2.0	11	1.5	11	1.5	11	2.0	11	2.0	12	2.0	12	3.0
	0.75"	9	1.5	11	1.5	11	2.0	11	1.5	11	2.0	11	3.0	11	2.0	12	2.0	12	3.0
	1.0"	9	1.5	11	2.0	11	3.0	11	2.0	11	2.0	11	3.0	11	2.0	12	2.0	12	3.0
SUPPLY RECOVERY FACTOR		.65		.63		.62		.60		.59		.57		.58		.57		.55	
PLUMBING DATA	GPM@40 PSI	5						4.5						4					
	H.W. SIZE	1/2"						1/2"						1/2"					
	DRAIN SIZE	1 1/2"						1 1/2"						1 1/2"					



HRU FRAME SIZE - 4

TOTAL AIR CAPACITY
RANGE (COMBINED
EXHAUST AND SUPPLY)
6000 TO 7500 CFM

OVERALL SIZE

LENGTH: 10'-0"

WIDTH: 8'-0"

HEIGHT: 4'-9"

DOES NOT INCLUDE EXHAUST
OUTLET DUCT COLLAR

WEIGHT: 3000 LBS.

COIL DATA

SIZE: 30" x 72"

FACE AREA: 15 SQ. FT.

RANGE: 450-560 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D - 140° MIN.

180° MAX.

WATER PRESS. - 40 PSI MIN.

80 PSI MAX.

AVERAGE WASH CYCLE
BETWEEN 5 - 7 MIN.

SUPPLY TO EXHAUST RATIO		80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	3300		3700		4000		3200		3600		4000		3000		3400		3700	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	1.5"	18	3.0	18	3.0	20	3.0	18	2.0	18	3.0	20	3.0	18	2.0	18	3.0	18	3.0
	2.0"	18	3.0	18	3.0	18	5.0	18	3.0	18	3.0	18	5.0	18	3.0	18	3.0	18	5.0
	2.5"	15	5.0	18	5.0	18	5.0	15	5.0	18	5.0	18	5.0	18	5.0	18	5.0	18	5.0
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	2600		2950		3200		2900		3200		3600		3000		3400		3700	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	0.5"	11	1.5	12	2.0	12	2.0	12	2.0	12	2.0	12	3.0	12	2.0	12	2.0	12	3.0
	0.75"	11	2.0	12	2.0	12	3.0	12	2.0	12	3.0	12	3.0	12	2.0	12	2.0	12	3.0
	1.0"	11	2.0	12	2.0	12	3.0	12	2.0	12	3.0	12	3.0	12	2.0	12	2.0	12	3.0
SUPPLY RECOVERY FACTOR		.65		.63		.62		.60		.59		.57		.58		.56		.54	
PLUMBING DATA	GPM @ 40 PSI	6						5.5						5					
	H.W. SIZE	3/4"						3/4"						3/4"					
	DRAIN SIZE	1 1/2"						1 1/2"						1 1/2"					

HRU FRAME SIZE - 5

TOTAL AIR CAPACITY
RANGE (COMBINED
EXHAUST AND SUPPLY)
7500 TO 9000 CFM

OVERALL SIZE

LENGTH: 10'-0"

WIDTH: 8'-0"

HEIGHT: 5'-6"

DOES NOT INCLUDE EXHAUST
OUTLET DUCT COLLAR

WEIGHT: 3200 LBS.

COIL DATA

SIZE: 36" x 72"

FACE AREA: 18 SQ. FT.

RANGE: 440-530 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D - 140° MIN.

180° MAX.

WATER PRESS. - 40 PSI MIN.

80 PSI MAX.

AVERAGE WASH CYCLE
BETWEEN 5 - 7 MIN.

SUPPLY TO EXHAUST RATIO		80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	4100		4500		4900		4000		4400		4700		3800		4100		4500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.		
	1.5"	20	3.0	20	5.0	20	5.0	20	3.0	20	5.0	20	5	20	3.0	20	3.0	20	5.0
	2.0"	20	3.0	20	5.0	20	5.0	20	3.0	20	5.0	20	5	20	3.0	20	5.0	20	5.0
	2.5"	18	5.0	20	5.0	20	5.0	18	5.0	20	5.0	20	5	18	5.0	18	5.0	20	5.0
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	3300		3600		3900		3600		4000		4200		3800		4100		4500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.		
	0.5"	12	2.0	12	3.0	12	3.0	12	2.0	12	3.0	12	3.0	12	3.0	12	3.0	12	5.0
	0.75"	12	2.0	12	3.0	12	3.0	12	3.0	12	3.0	12	3.0	12	3.0	12	3.0	12	5.0
	1.0"	12	3.0	12	3.0	12	3.0	12	3.0	12	3.0	12	5.0	12	3.0	12	5.0	12	5.0
SUPPLY RECOVERY FACTOR		.65		.63		.62		.60		.59		.57		.58		.57		.55	
PLUMBING DATA	GPM@40 PSI	6.5"						6.5"						6.5"					
	H.W. SIZE	3/4"						3/4"						3/4"					
	DRAIN SIZE	2"						2"						2"					

HRU FRAME SIZE - 6

TOTAL AIR CAPACITY
RANGE (COMBINED
EXHAUST AND SUPPLY)
9000 TO 11000 CFM

OVERALL SIZE

LENGTH: 11'-0"

WIDTH: 8'-0"

HEIGHT: 6'-3"

DOES NOT INCLUDE EXHAUST
OUTLET DUCT COLLAR
WEIGHT: 3500 LBS.

COIL DATA

SIZE: 42" x 72"

FACE AREA: 21 SQ. FT.

RANGE: 440-540 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D - 140° MIN.
180° MAX.

WATER PRESS. - 40 PSI MIN.
80 PSI MAX.

AVERAGE WASH CYCLE
BETWEEN 5 - 7 MIN.

SUPPLY TO EXHAUST RATIO		80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	5000		5500		6000		4800		5300		5800		4500		5000		5500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	1.5"	20	5.0	20	5.0	22	5.0	20	3.0	20	5.0	20	5.0	20	3.0	20	5.0	20	5.0
	2.0"	20	5.0	20	5.0	20	7.5	20	5.0	20	5.0	20	7.5	20	5.0	20	5.0	20	5.0
	2.5"	20	5.0	20	5.0	20	7.5	20	5.0	20	5.0	20	7.5	20	5.0	20	5.0	20	7.5
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	4000		4400		4800		4300		4800		5200		4500		5000		5500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	0.5"	12	3.0	12	3.0	13	3.0	12	3.0	13	3.0	13	5.0	12	3.0	13	5.0	15	5.0
	0.75"	12	3.0	12	5.0	12	5.0	12	3.0	13	5.0	13	5.0	12	3.0	13	5.0	15	5.0
	1.0"	12	3.0	12	5.0	12	5.0	12	3.0	13	5.0	13	5.0	12	5.0	13	5.0	15	5.0
SUPPLY RECOVERY FACTOR		.65		.63		.62		.60		.59		.57		.58		.57		.55	
PLUMBING DATA	GPM @ 40 PSI	8						7.5						7					
	H.W. SIZE	1"						1"						1"					
	DRAIN SIZE	2"						2"						2"					

HRU FRAME SIZE - 7

TOTAL AIR CAPACITY
RANGE (COMBINED
EXHAUST AND SUPPLY)
10000 TO 13000 CFM

OVERALL SIZE

LENGTH: 11'-6"

WIDTH: 8'-0"

HEIGHT: 7'-0"

DOES NOT INCLUDE EXHAUST
OUTLET DUCT COLLAR
WEIGHT: 3900 LBS.

COIL DATA

SIZE: 48" x 72"

FACE AREA: 24 SQ. FT.

RANGE: 460-550 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D - 140° MIN.
180° MAX.

WATER PRESS. - 40 PSI MIN.
80 PSI MAX.

AVERAGE WASH CYCLE
BETWEEN 5 - 7 MIN.

SUPPLY TO EXHAUST RATIO		80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	6100		6600		7100		5800		6400		6900		5500		6000		6500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	1.5"	22	5.0	22	7.5	24	7.5	22	5.0	22	5.0	24	7.5	20	5.0	22	5.0	22	7.5
	2.0"	22	5.0	22	7.5	24	7.5	22	5.0	22	7.5	24	7.5	20	5.0	22	5.0	22	7.5
	2.5"	20	7.5	22	7.5	22	7.5	20	7.5	22	7.5	22	7.5	20	5.0	20	7.5	22	7.5
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	4900		5300		5700		5200		5800		6200		5500		6000		6500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	0.5"	13	3.0	15	5.0	15	5.0	13	3.0	15	5.0	15	5.0	15	3.0	15	5.0	16	5.0
	0.75"	13	3.0	15	5.0	15	5.0	13	5.0	15	5.0	15	5.0	15	5.0	15	5.0	16	5.0
	1.0"	12	5.0	13	5.0	15	5.0	13	5.0	13	5.0	15	5.0	15	5.0	13	5.0	15	5.0
SUPPLY RECOVERY FACTOR		.65		.64		.62		.59		.58		.56		.58		.56		.54	
PLUMBING DATA	GPM@40 PSI	9.5						9						8.5					
	H.W. SIZE	1"						1"						1"					
	DRAIN SIZE	2"						2"						2"					



HRU FRAME SIZE - 8

TOTAL AIR CAPACITY
RANGE (COMBINED
EXHAUST AND SUPPLY)
13000 TO 16000 CFM

OVERALL SIZE

LENGTH: 13'-0"

WIDTH: 8'-0"

HEIGHT: 8'-0"

DOES NOT INCLUDE EXHAUST
OUTLET DUCT COLLAR

WEIGHT: 4200 LBS.

COIL DATA

SIZE: 54" x 72"

FACE AREA: 27 SQ. FT.

RANGE: 480-590 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D - 140° MIN.
180° MAX.

WATER PRESS. - 40 PSI MIN.
80 PSI MAX.

AVERAGE WASH CYCLE
BETWEEN 5-7 MIN.

SUPPLY TO EXHAUST RATIO		80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	7200		8000		8800		7000		7700		8500		6500		7300		8000	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	1.5"	27	5.0	27	7.5	30	7.5	24	5.0	27	7.5	27	7.5	24	5.0	27	5.0	27	7.5
	2.0"	27	7.5	27	7.5	30	7.5	24	7.5	27	7.5	27	7.5	24	5.0	27	7.5	27	7.5
	2.5"	24	7.5	27	7.5	27	10.0	24	7.5	27	7.5	27	10.0	24	7.5	27	7.5	27	10.0
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	5800		6400		7000		6300		7000		7500		6500		7300		8000	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	0.5"	15	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	18	5.0
	0.75"	15	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	18	7.5
	1.0"	15	5.0	16	5.0	16	7.5	16	5.0	16	5.0	16	7.5	16	5.0	16	7.5	18	7.5
SUPPLY RECOVERY FACTOR		.63		.62		.60		.59		.57		.56		.57		.55		.53	
PLUMBING DATA	GPM @40 PSI	12						11						10.5					
	H.W. SIZE	1 1/4"						1 1/4"						1 1/4"					
	DRAIN SIZE	3"						3"						3"					

HRU FRAME SIZE-9A,B, or C

TOTAL AIR CAPACITY
RANGE (COMBINED
EXHAUST AND SUPPLY)
16000 TO 22000 CFM * *

OVERALL SIZE

LENGTH: WIDTH: *HEIGHT:

(A) 13'-0" (A) 10'-0" (A) 7'-9"

(B) 13'-0" (B) 10'-0" (B) 8'-0"

(C) 13'-8" (C) 10'-0" (C) 8'-3"

WEIGHT:

(A) 4500 LBS. * DOES NOT INCLUDE
(B) 4800 LBS. EXHAUST OUTLET
(C) 5000 LBS. DUCT COLLAR

COIL DATA

SIZE: 54" x 96"

FACE AREA: 36 SQ. FT.

RANGE: 440-610 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D - 140° MIN.
180° MAX.

WATER PRESS. - 40 PSI MIN.
80 PSI MAX.

AVERAGE WASH CYCLE
BETWEEN 5-7 MIN.

SUPPLY TO EXHAUST RATIO		80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	A 9000		B 10500		C 12000		A 8500		B 10000		C 11500		A 8000		B 9500		C 11000	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	1.5"	27	7.5	30	10.0	30	10.0	27	7.5	30	10.0	30	10.0	27	7.5	30	10.0	30	10.0
	2.0"	27	7.5	30	10.0	30	10.0	27	7.5	30	10.0	30	10.0	27	7.5	30	10.0	30	10.0
	2.5"	27	10.0	30	10.0	30	15.0	27	7.5	30	10.0	30	15.0	27	7.5	30	10.0	30	15.0
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	A 7200		B 8500		C 9600		A 7500		B 9000		C 10500		A 8000		B 9500		C 11000	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	0.5"	16	5.0	18	5.0	20	7.5	16	5.0	20	5.0	20	7.5	18	5.0	20	7.5	20	7.5
	0.75"	16	5.0	18	7.5	20	7.5	16	5.0	20	7.5	20	7.5	18	5.0	20	7.5	20	10.0
	1.0"	16	5.0	18	7.5	20	7.5	16	5.0	20	7.5	20	10.0	18	5.0	20	7.5	20	10.0
SUPPLY RECOVERY FACTOR		.65		.62		.60		.61		.58		.54		.58		.56		.53	
PLUMBING DATA	GPM @40 PSI	15						14.5						13.5					
	H.W. SIZE	1 1/4"						1 1/4"						1 1/4"					
	DRAIN SIZE	3"						3"						3"					

* * NOTE: UNITS OVER 22,000 CFM AVAILABLE: CONSULT FACTORY

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd. Suite C-200
 Denver, CO 80227 (303) 988-2951
 9755 Dogwood Rd. Suite 220
 Roswell, GA 30075 (404) 642-1864

Kitchen Heat Recovery Units.

JOB 1406-005 HVAC Upgrade FTRiley, Ks

SHEET NO. _____ OF _____

CALCULATED BY C. Wohlent DATE 2/24/95

CHECKED BY _____ DATE _____

SCALE Building 7245

Rex Cooper

Gaylord Industries, inc

1-800-547-9696

Size 2 = 3,500 → 5000 cfm (supply + exhaust)

\$ 11,900

coil = \$4,000 w/ all controls

2,500 wash system

} total ~~\$14,300~~ \$ 14,300

Size 1 = 11,000 unit

3,000 coil

2,500 cabinet

16,500 total

2,500 - 3,500 total cfm

Size 3 = 15,500 unit

4,000 coil

3,000 cabinet

\$ 22,500 total

7,500 - 9,500 total cfm

Size 5

21,000 unit

4,500 coil

3,000 cabinet

\$ 28,500

13,000 - 16,000 total cfm

Size 7C

27,000 unit

5,000 coil

4,500 cabinet

\$ 36,500

16,000 - 22,000 total cfm



LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 7245 - Replace Large STM Boiler w/ Smaller STM & HW Boilers

A. CONSTRUCTION COST	=	\$65,099
B. SIOH COST	(5.5% of 1A) =	\$3,580
C. DESIGN COST	(6.0% of 1A) =	\$3,906
D. TOTAL COST	(1A + 1B + 1C) =	\$72,585
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$72,585

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	(111)	(\$1,338)	15.88	(\$21,247)
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	1,528	\$6,295	18.30	\$115,205
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$0	14.88	\$0
F. TOTAL		1,417	\$4,957		-----> \$93,958

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	(\$181)	14.88	(\$2,693)
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	(\$181)		(\$2,693)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	\$101,942	5	0.863	\$87,976
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$101,942			\$87,976

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$85,284

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$9,874
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.35
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$179,241
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	2.47

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET 1 OF 1		DATE PREPARED 4-May-95		1	
ENGINEER		E M C Engineers, Inc. Denver, CO		ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7245							
2		PROPOSED SYSTEM MODIFICATIONS							
3		NEW SYSTEMS INSTALLATION							
4		BOILER, STEAM, 2 MBH, 85%	EA.	1.0	\$15,640	\$15,640	Q-7	35.556	\$731
5		BOILER, HOT WATER, 2 MBH, 85%	EA.	1.0	\$16,110	\$16,110	Q-7	32	\$658
6		STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	90.0	\$3.91	\$352	Q-1	0.25	\$436
7	STLPIP2	VALVES & FITTINGS, 25%				\$88			\$109
8		2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90.0	\$1.46	\$132	Q-14	0.084	\$139
9	INSLPIP2	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	25.0	\$17.93	\$448	Q-16	0.667	\$362
10	STLPIP6	FITTINGS, 10%				\$45			\$36
11		6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	\$2.18	\$55	Q-14	0.145	\$67
12	INSLPIP6	PUMP, 5 HP	EA	1.0	\$1,114.35	\$1,114	Q-1	8.889	\$172
13	PMP5HP								
14									
15									
16									
17									
18									
19									
20									
21		EXISTING SYSTEMS DEMOLITION							
22		BOILER DEMOLITION	EA.	1.0			Q-6	275	\$5,529
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$33,984			\$8,240
32	OH	OVERHEAD			17%	\$5,709			\$1,384
33	PRO	PROFIT			10%	\$3,969			\$962
34	CONT	CONTINGENCY			20%	\$8,733			\$2,117
35	TOTAL COST					\$52,395			\$12,704
									\$42,224
									\$7,094
									\$4,932
									\$10,850
									\$65,099

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade			SHEET		1		OF	1
ENGINEER		E M C Engineers, Inc. Denver, CO			DATE PREPARED		4-May-95			
					ESTIMATOR		C. Wohliert			
					CHECKED BY		A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7245								
2		NON-RECURRING								
3										
4		BASELINE - EXISTING EQUIP. REPLACEMENT								
5	BOIL6.97	CAST IRON STEAM BOILER, 6.97 MBH	EA.	1.0	\$51,357	\$51,357	Q-7	400	\$8,222	\$59,579
6	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	25.0	\$17.93	\$448	Q-16	0.667	\$362	\$810
7		FITTINGS, 10%				\$45			\$36	\$81
8	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	\$2.18	\$55	Q-14	0.145	\$67	\$121
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21		EXISTING SYSTEMS DEMOLITION								
22		BOILER DEMOLITION	EA.	1.0			Q-6	275	\$5,529	\$5,529
23										
24										
25										
26										
27										
28										
29										
30										
31		SUBTOTAL				\$51,904			\$14,216	\$66,121
32	OH	OVERHEAD			17%	\$8,720			\$2,388	\$11,108
33	PRO	PROFIT			10%	\$6,062			\$1,660	\$7,723
34	CONT	CONTINGENCY			20%	\$13,337			\$3,653	\$16,990
35		TOTAL COST				\$80,024			\$21,918	\$101,942

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 7245							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	\$96.90	\$97	Q-6	25	\$503
5									\$600
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$97	-	-	\$503
16									\$600
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
18	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	2.0	\$48.45	\$97	Q-6	17	\$684
19									\$780
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$97	-	-	\$684
30									\$780
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	(\$181)

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE: 05/24/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDGS 7606 and 7654 (each) - Replace Large STM Boiler w/ Smaller STM & HW Boilers

A. CONSTRUCTION COST	=	\$80,100
B. SIOH COST	(5.5% of 1A) =	\$4,406
C. DESIGN COST	(6.0% of 1A) =	\$4,806
D. TOTAL COST	(1A + 1B + 1C) =	\$89,312
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$89,312

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COS \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	(111)	(\$1,338)	15.88	(\$21,247)
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	1,528	\$6,295	18.30	\$115,205
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$0	14.88	\$0
F. TOTAL		1,417	\$4,957		-----> \$93,958

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	(\$181)	14.88	(\$2,693)
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	(\$181)		(\$2,693)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	\$101,942	5	0.863	\$87,976
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$101,942			\$87,976

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$85,284

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$9,874

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 9.05

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$179,241

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 2.01
(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET 1 OF 1		DATE PREPARED 24-May-95			
ENGINEER		E M C Engineers, Inc. Denver, CO		ESTIMATOR		C. Wohlert			
				CHECKED BY		A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDINGS 7606 and 7654 (each)							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5		BOILER, STEAM, 2 MBH, 85%	EA.	1.0	\$15,640	Q-7	35.556	\$731	\$16,371
6		BOILER, HOT WATER, 2 MBH, 85%	EA.	1.0	\$16,110	Q-7	32	\$658	\$16,768
7	STLPIP2	STEEL PIPE SCH. 40, 2" WHANGERS	L.F.	90.0	\$3.91	Q-1	0.25	\$436	\$789
8		VALVES & FITTINGS, 25%			\$88			\$109	\$197
9	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90.0	\$1.46	Q-14	0.084	\$139	\$271
10	STLPIP6	STEEL PIPE SCH. 40, 6" WHANGERS	L.F.	25.0	\$17.93	Q-16	0.667	\$362	\$810
11		FITTINGS, 10%			\$45			\$36	\$81
12	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	\$2.18	Q-14	0.145	\$67	\$121
13	PMP5HP	PUMP, 5 HP	EA	1.0	\$1,114.35	Q-1	8.889	\$172	\$1,287
14									
15									
16									
17									
18									
19									
20									
21		EXISTING SYSTEMS DEMOLITION							
22		BOILER DEMOLITION	EA.	1.0		Q-6	275	\$5,529	\$5,529
23		ASBESTOS REMOVAL (HRU)	GLV. BAG	38.0	\$170.00				\$6,460
24		ASBESTOS REMOVAL (BOILER)	FLUE	1.0	\$3,270.00				\$3,270
25									
26									
27									
28									
29									
30									
31		SUBTOTAL			\$43,714			\$8,240	\$51,954
32	OH	OVERHEAD			17%			\$1,384	\$8,728
33	PRO	PROFIT			10%			\$962	\$6,068
34	CONT	CONTINGENCY			20%			\$2,117	\$13,350
35	TOTAL COST				\$67,396			\$12,704	\$80,100

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade			SHEET 1 OF 1		DATE PREPARED 24-May-95		
ENGINEER		E M C Engineers, Inc. Denver, CO			ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDINGS 7606 and 7654 (each)							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	\$96.90	\$97	Q-6	25	\$503
5									\$600
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$97	-	-	\$503
16									\$600
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
18	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	2.0	\$48.45	\$97	Q-6	17	\$684
19									\$780
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$97	-	-	\$684
30									\$780
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	(\$181)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1			
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED 24-May-95			
						ESTIMATOR C. Wohliert			
						CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDINGS 7606 and 7654 (each)							
2		NON-RECURRING							
3									
4		BASELINE - EXISTING EQUIP. REPLACEMENT							
5	BOIL6.97	CAST IRON STEAM BOILER, 6.97 MBH	EA.	1.0	\$51,357	\$51,357	Q-7	400	\$8,222
6	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	25.0	\$17.93	\$448	Q-16	0.667	\$362
7		FITTINGS, 10%				\$45			\$36
8	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	\$2.18	\$55	Q-14	0.145	\$67
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21		EXISTING SYSTEMS DEMOLITION							
22		BOILER DEMOLITION	EA.	1.0			Q-6	275	\$5,529
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$51,904			\$14,216
32	OH	OVERHEAD			17%	\$8,720			\$2,388
33	PRO	PROFIT			10%	\$6,062			\$1,660
34	CONT	CONTINGENCY			20%	\$13,337			\$3,653
35		TOTAL COST				\$80,024			\$21,918
									\$66,121
									\$11,108
									\$7,723
									\$16,990
									\$101,942

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE:	05/24/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: **BLDGS 7804 and 7856 (each) - Replace Large STM Boiler w/ Smaller STM & HW Boilers**

A. CONSTRUCTION COST	=	\$70,140
B. SIOH COST	(5.5% of 1A) =	\$3,858
C. DESIGN COST	(6.0% of 1A) =	\$4,208
D. TOTAL COST	(1A + 1B + 1C) =	\$78,207
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$78,207

2. ENERGY SAVINGS (+) OR COST (-):
 DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

ENERGY SOURCE	FUEL COS \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	(111)	(\$1,338)	15.88	(\$21,247)
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	1,528	\$6,295	18.30	\$115,205
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$0	14.88	\$0
F. TOTAL		1,417	\$4,957		-----> \$93,958

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)					
1 ANNUAL MAINTENANCE			(\$181)	14.88	(\$2,693)
2			\$0	14.88	\$0
3			\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST			(\$181)		(\$2,693)
B. NON-RECURRING (+/-)					
ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)	
				(TABLE A-2)	
a. BASELINE EQUIP. REPLACEMEN	\$101,942	5	0.863	\$87,976	
b.				\$0	
c.				\$0	
d.				\$0	
e.				\$0	
f. TOTAL	\$101,942			\$87,976	
C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)			(3A4 + 3Bf4) =		\$85,284

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$9,874
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 7.92
6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$179,241
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 2.29
 (MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF 1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		24-May-95	
						ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDINGS 7804 and 7856 (each)							
2		PROPOSED SYSTEM MODIFICATIONS							
3		NEW SYSTEMS INSTALLATION							
4		BOILER, STEAM, 2 MBH, 85%	EA.	1.0	\$15,640	Q-7	35.556	\$731	\$16,371
5		BOILER, HOT WATER, 2 MBH, 85%	EA.	1.0	\$16,110	Q-7	32	\$658	\$16,768
6		STEEL PIPE SCH. 40, 2" WHANGERS	L.F.	90.0	\$3.91	Q-1	0.25	\$436	\$789
7	STLPIP2	VALVES & FITTINGS, 25%			\$88			\$109	\$197
8		2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90.0	\$1.46	Q-14	0.084	\$139	\$271
9	INSLPIP2	STEEL PIPE SCH. 40, 6" WHANGERS	L.F.	25.0	\$17.93	Q-16	0.667	\$362	\$810
10	STLPIP6	FITTINGS, 10%			\$45			\$36	\$81
11		6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	\$2.18	Q-14	0.145	\$67	\$121
12	INSLPIP6	PUMP, 5 HP	EA	1.0	\$1,114.35	Q-1	8.889	\$172	\$1,287
13	PMP5HP								
14									
15									
16									
17									
18									
19									
20									
21		EXISTING SYSTEMS DEMOLITION							
22		BOILER DEMOLITION	EA.	1.0		Q-6	275	\$5,529	\$5,529
23		ASBESTOS REMOVAL (BOILER)	FLUE	1.0				\$3,270	\$3,270
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL			\$33,984			\$11,510	\$45,494
32	OH	OVERHEAD			17%			\$1,934	\$7,643
33	PRO	PROFIT			10%			\$1,344	\$5,314
34	CONT	CONTINGENCY			20%			\$2,958	\$11,690
35	TOTAL COST				\$52,395			\$17,745	\$70,140

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 24-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		Total	LABOR COST		
				Quantity	Unit Cost		Crew/ Worker	Hours/ Unit	Total
1		BUILDINGS 7804 and 7856 (each)							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	\$96.90	\$97	Q-6	25	\$503
5									\$600
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$97	-	-	\$503
16									\$600
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
18	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	2.0	\$48.45	\$97	Q-6	17	\$684
19									\$780
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$97	-	-	\$684
30									\$780
31									
32									
33									
34		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	(\$181)
35									(\$181)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 24-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7804 and 7856 (each)							
2		NON-RECURRING							
3									
4									
5	BOIL6.97	BASELINE - EXISTING EQUIP. REPLACEMENT	EA.	1.0	\$51,357	\$51,357	Q-7	400	\$8,222
6	STLPIP6	CAST IRON STEAM BOILER, 6.97 MBH	L.F.	25.0	\$17.93	\$448	Q-16	0.667	\$362
7		STEEL PIPE SCH. 40, 6" W/HANGERS				\$45			\$36
8	INSLPIP6	FITTINGS, 10%	L.F.	25.0	\$2.18	\$55	Q-14	0.145	\$67
9		6" FIBERGLASS PIPE INSULATION, 1.5" THCK							
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22		EXISTING SYSTEMS DEMOLITION	EA.	1.0			Q-6	275	\$5,529
23		BOILER DEMOLITION							
24									
25									
26									
27									
28									
29									
30									
31									
32									
33	OH	SUBTOTAL				\$51,904			\$14,216
34	PRO	OVERHEAD			17%	\$8,720			\$2,388
35	CONT	PROFIT			10%	\$6,062			\$1,660
		CONTINGENCY			20%	\$13,337			\$3,653
		TOTAL COST				\$80,024			\$21,918
									\$66,121
									\$11,108
									\$7,723
									\$16,990
									\$101,942

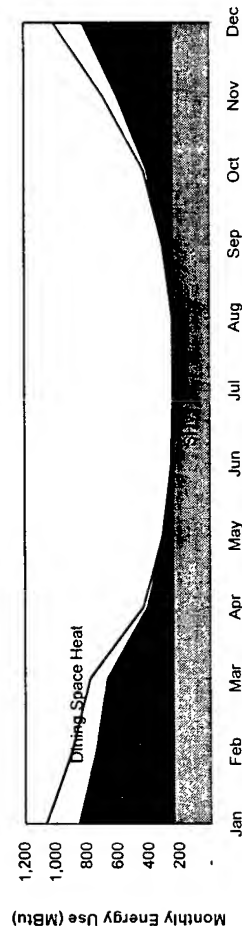
EVALUATION OF DEDICATED BOILERS FOR SERVICE WATER AND SPACE HEATING - BUILDING 7245 (DINING FACILITY)

Equipment	Units	Btuh	MBtu/yr	Notes
Steam kettles (10 qrt)	2	18,447	56	5405 watts, 8.25 hrs/day
DHW Converter	1	1,626,300	2,849	1000 people, 3000 meals, 1.5 gal/hr/meal, 50 to 180 F, 2.4 gal/day/meal
Kitchen MAU Units	2	1,099,000	2,943	From baseline computer simulation
Dining AHUs	2	-	-	
HW Baseboard Converter	1	454,000	819	From baseline computer simulation
Total		3,197,747	6,667	

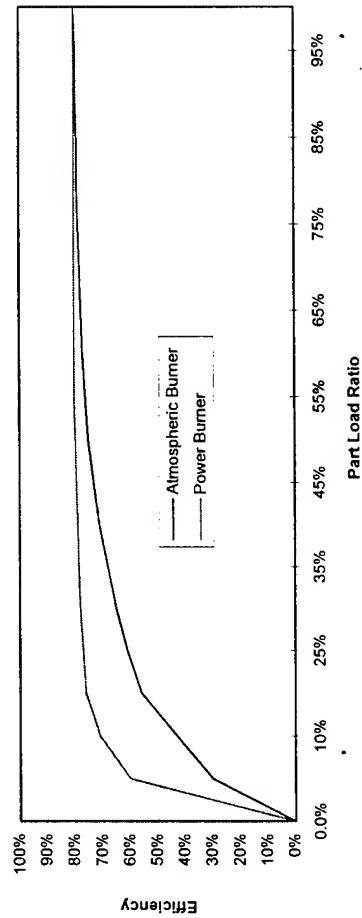
Total DHW & Steam kettles	Kitchen	1,644,747	2,905
Total Space Heating		1,553,000	3,762

Existing Steam Boiler	6,900,000	Output
-----------------------	-----------	--------

Annual Load Profile



Boiler Efficiency Curves



Boiler Efficiency Curve

% Full Load	Atm Burner Efficiency	Power Burner Efficiency
0.0%	0.0%	0.0%
2.5%	20.0%	40.0%
5%	30.0%	60.0%
10%	43.0%	71.0%
15%	50.0%	73.5%
20%	56.0%	76.0%
25%	61.0%	77.0%
30%	65.0%	78.0%
35%	68.0%	78.4%
40%	71.0%	78.8%
45%	73.0%	79.2%
50%	75.0%	79.6%
55%	76.0%	80.0%
60%	77.0%	80.0%
65%	77.5%	80.0%
70%	78.0%	80.0%
75%	78.5%	80.0%
80%	79.0%	80.0%
85%	79.0%	80.0%
90%	79.5%	80.0%
95%	79.5%	80.0%
100%	80.0%	80.0%

EVALUATION OF DEDICATED BOILERS FOR SERVICE WATER AND SPACE HEATING - BUILDING 7245 (DINING FACILITY)

Atmospheric Boiler

Load Profile		Existing Boiler 6,900,000 Btuh				Proposed DHW Boiler 2,000,000 Btuh				Proposed Space Heat Boiler 2,000,000 Btuh			
Month	DHW (MBtu/mo)	Kitchen Space Heat (MBtu/mo)	Dining Space Heat (MBtu/mo)	Total (MBtu/mo)	% Full Load	Avg Boiler Efficiency	Boiler Energy Use (MBtu/mo)	% Full Load	Avg Boiler Efficiency	DHW Energy Use (MBtu/mo)	% Full Load	Avg Boiler Efficiency	Total Energy Use (MBtu/mo)
Jan	242	613	211	1,066	21%	76%	1,403	17%	74%	329	57%	80%	1,359
Feb	242	500	156	898	18%	74%	1,222	17%	74%	329	46%	79%	1,158
Mar	242	425	113	780	16%	74%	1,061	17%	74%	329	37%	78%	1,016
Apr	242	166	28	436	9%	60%	727	17%	74%	329	13%	71%	603
May	242	63	5	310	6%	60%	517	17%	74%	329	5%	40%	329
Jun	242	12	0	254	5%	60%	423	17%	74%	329	1%	0%	329
Jul	242	1	0	243	5%	40%	608	17%	74%	329	0%	0%	329
Aug	242	2	0	244	5%	40%	610	17%	74%	329	0%	0%	329
Sep	242	66	0	308	6%	60%	513	17%	74%	329	5%	40%	329
Oct	242	164	24	430	9%	60%	717	17%	74%	329	13%	71%	594
Nov	242	354	93	689	14%	71%	971	17%	74%	329	31%	78%	902
Dec	242	579	189	1,010	20%	76%	1,329	17%	74%	329	53%	80%	1,294
Year	2,905	2,945	819	6,669			10,101			3,952			8,573

Power Burner Boiler

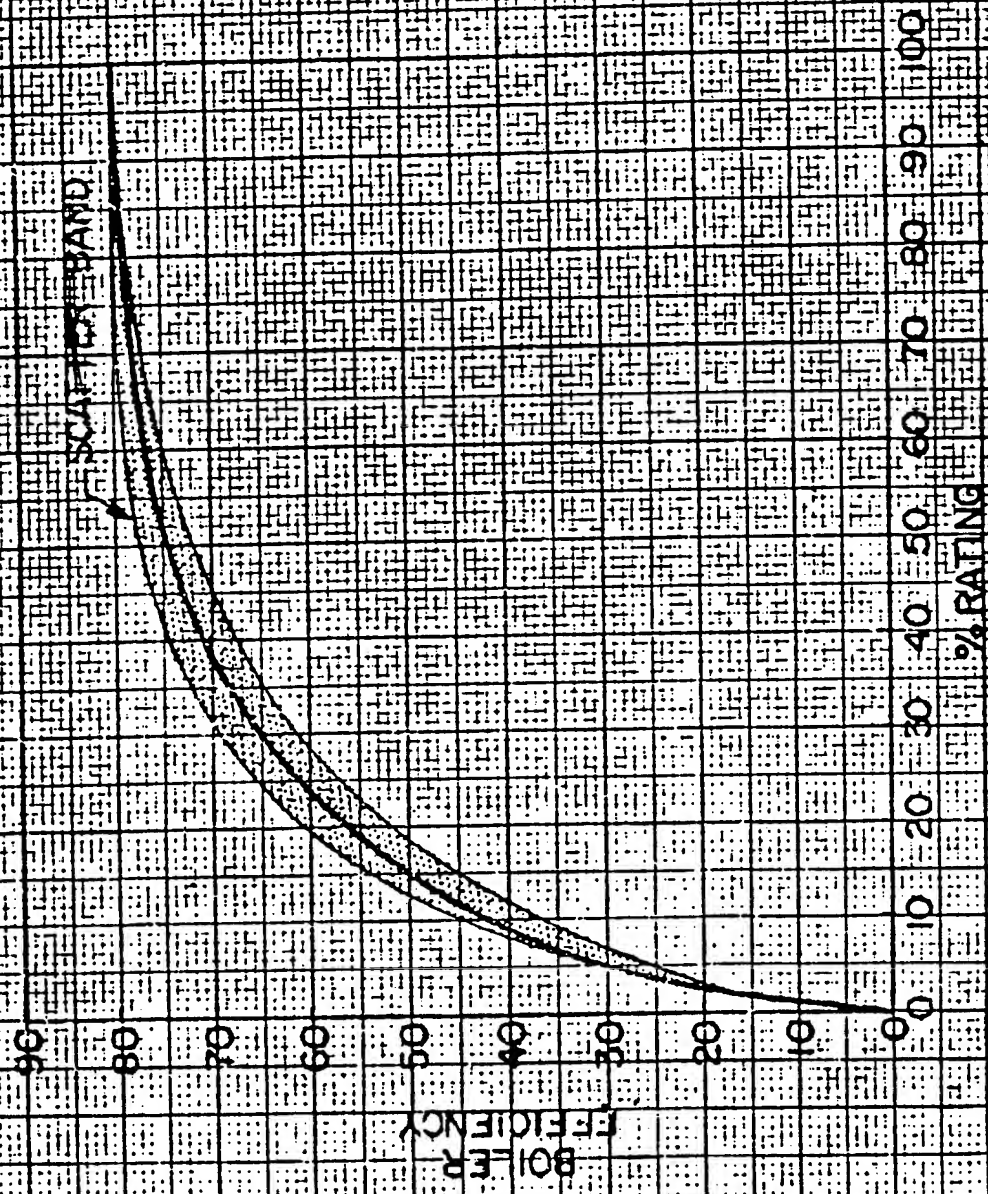
Load Profile		Existing Boiler 6,900,000 Btuh				Proposed DHW Boiler 2,000,000 Btuh				Proposed Space Heat Boiler 2,000,000 Btuh			
Month	DHW (MBtu/mo)	Kitchen Space Heat (MBtu/mo)	Dining Space Heat (MBtu/mo)	Total (MBtu/mo)	% Full Load	Avg Boiler Efficiency	Boiler Energy Use (MBtu/mo)	% Full Load	Avg Boiler Efficiency	DHW Energy Use (MBtu/mo)	% Full Load	Avg Boiler Efficiency	Total Energy Use (MBtu/mo)
Jan	242	613	211	1,066	21%	56%	1,904	17%	74%	329	57%	80%	1,359
Feb	242	500	156	898	18%	50%	1,796	17%	74%	329	46%	79%	1,158
Mar	242	425	113	780	16%	50%	1,560	17%	74%	329	37%	78%	1,016
Apr	242	166	28	436	9%	30%	1,454	17%	74%	329	13%	71%	603
May	242	63	5	310	6%	30%	1,034	17%	74%	329	5%	40%	329
Jun	242	12	0	254	5%	30%	847	17%	74%	329	1%	0%	329
Jul	242	1	0	243	5%	20%	1,215	17%	74%	329	0%	0%	329
Aug	242	2	0	244	5%	20%	1,220	17%	74%	329	0%	0%	329
Sep	242	66	0	308	6%	30%	1,027	17%	74%	329	5%	40%	329
Oct	242	164	24	430	9%	30%	1,434	17%	74%	329	13%	71%	594
Nov	242	354	93	689	14%	43%	1,602	17%	74%	329	31%	78%	902
Dec	242	579	189	1,010	20%	56%	1,804	17%	74%	329	53%	80%	1,294
Year	2,905	2,945	819	6,669			16,896			3,952			8,573

THE OHIO STATE UNIVERSITY
ENGINEERING EXPERIMENT STATION

LEGAL AIDS

BOILER EFFICIENCY VS. % RATING

FIGURE 2



QUOTATION



INDUSTRIAL - DENVER COMPANY

PROFESSIONAL SALES ENGINEERS • MANUFACTURERS' AGENTS
5717 WEST 6TH AVENUE • DENVER, COLORADO 80214
PHONE: (303) 232-2864 • FAX (303) 237-9692

QUOTE NO. BUDGET

Date 3-7-95

TO: EMC ENGINEERS

ATTN: ~~Dennis Jones~~

SUBJECT

Fort Riley
Manhattan, KS

[illegible]

NOTES

FREIGHT

FFA

TOTAL

~~This quotation is subject to the terms and conditions printed on the reverse side of this page.~~

INDUSTRIAL DENVER COMPANY

Accepted for Purchaser _____ 19____

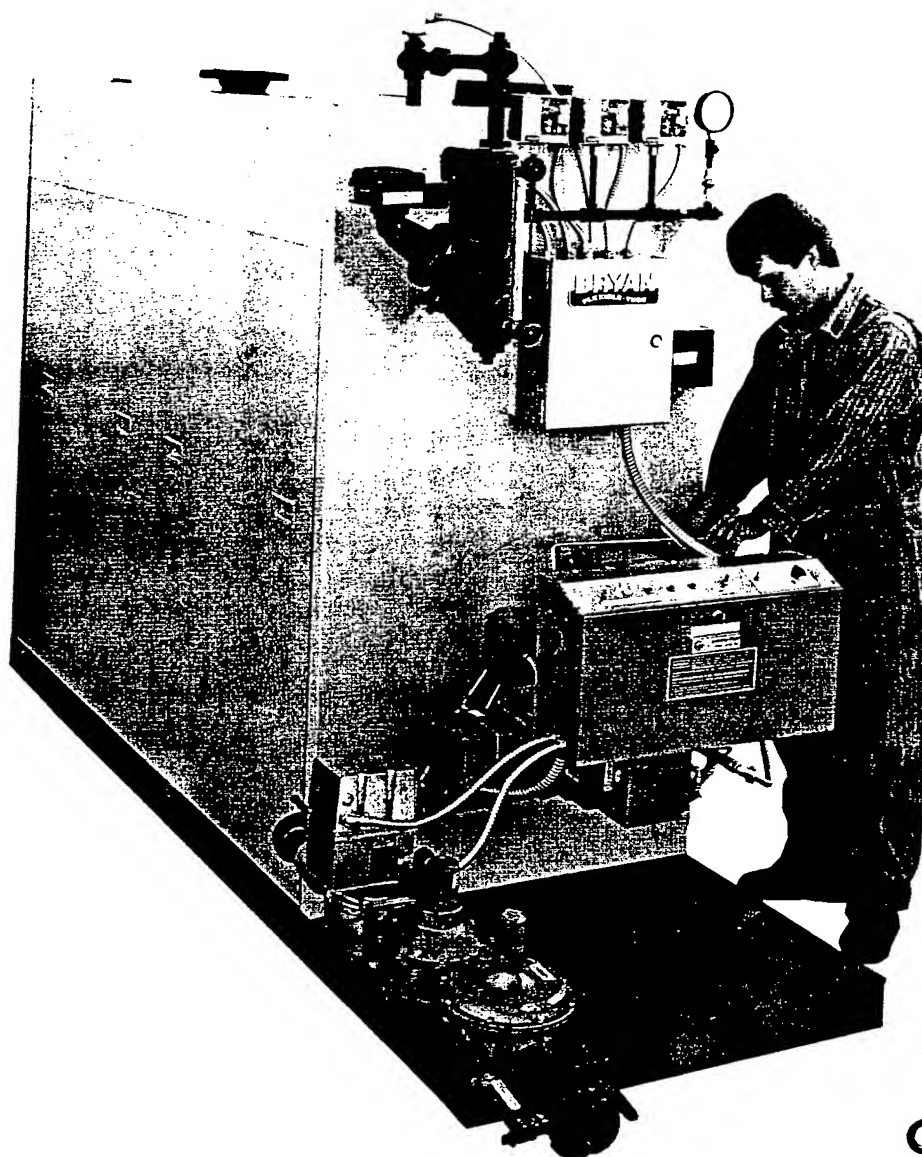
D7-52

(Name of Purchaser)

DUSTRIAL DENVER COMPANY
Carl Dahlberg

Forced Draft Gas, Oil or Dual Fuel Fired Water Tube Boilers

AB Series — Steam
900,000 to 2,500,000 BTUH
21 HP through 60 HP
15 psi to 150 psi



 **BRYAN BOILERS**

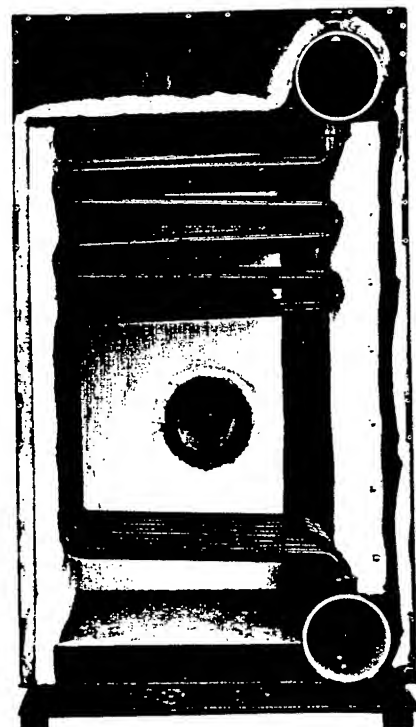
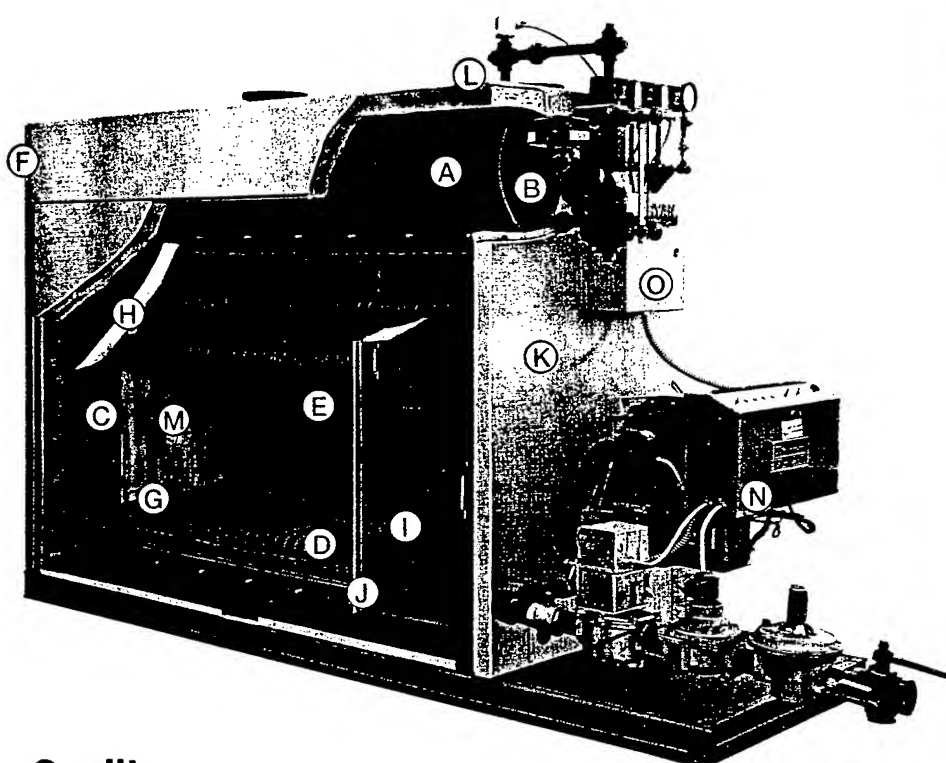
Featuring the exclusive Bryan "Flexible Water Tube" design



Performance efficiency breakthrough for commercial/industrial steam boilers

High efficiency steam heat guaranteed Featuring Bryan's "flexible water tube" design

- True bent water tube
- Pressurized firing for high efficiency
- High quality steam for heat or process
- Full 5 sq ft per BHP heating surface area



Quality Construction Features

A Heavy steel boiler frame, built and stamped in accordance with the appropriate ASME Boiler Code.

B Extra large drum with high steam release area ensures stable water level and dry steam.

C Large volume water leg downcomers promote rapid internal circulation for efficient heat transfer.

D Bryan bent water tubes are flexible, individually replaceable without welding or rolling.

E Water cooled furnace with low heat release.

F Water and steam side interior accessible for cleanout and inspection, front and rear openings, upper and lower drum.

G Pressurized design: Inner fireside casing constructed of heavy gauge steel, completely seal welded, lined with high temperature insulation and refractory.

H Boiler tube and furnace area access panels; Heavy gauge steel lined with high

temperature insulation and refractory, bolted and tightly sealed to boiler frame.

I Access panel: Front panels provide easy access for inspection, cleaning and access to burner head.

J Single side access: Combustion chamber, tubes and burner head are completely accessible from one side, simplifying maintenance, minimizing floor space.

K Heavy gauge steel boiler jacket with rust

resistant zinc coating and enamel finish. Insulated with fiberglass to ensure exceptionally cool outer surface.

L Minimum sized flue vent.

M Rear flame observation port.

N Forced draft, flame retention head type burner. Efficient combustion of oil or gas, quiet operation.

O Control panel: All controls installed and connected to terminal strip.

These unique features are available only on Bryan AB Series steam boilers

The Bryan Flexible Tube

Bryan's exclusive "flexible tube" design promotes high velocity internal circulation for maximum heat transfer and improved boiler efficiency. Tubes are easily removable and replaceable, without welding or rolling, eliminating long, expensive downtime should repairs ever be required.

Compact design, minimum floor space

With our compact water tube design, the overall size of the unit is less than most other types of boilers, yet provides a full five sq ft per BHP heating surface area. Needing only 25 inches for tube removal, and only on one side of the boiler, the AB Series boiler occupies very small space in the boiler room. This can result in considerable savings in building costs. Pressurized firing permits minimum sized breeching and vent.

Positive internal circulation

Each pass of the Bryan water tube slopes upward. This configuration, along with the large volume downcomer water legs, provides extremely rapid natural thermal internal circulation, promoting both high efficiency

of heat transfer and uniform temperature throughout the boiler.

Multi-pass flue gas travel

High velocity four pass flue gas travel is obtained by a unique baffling system. This contributes to maximum fire side heat transfer and overall high boiler efficiencies.

Accessibility of furnace and tube area

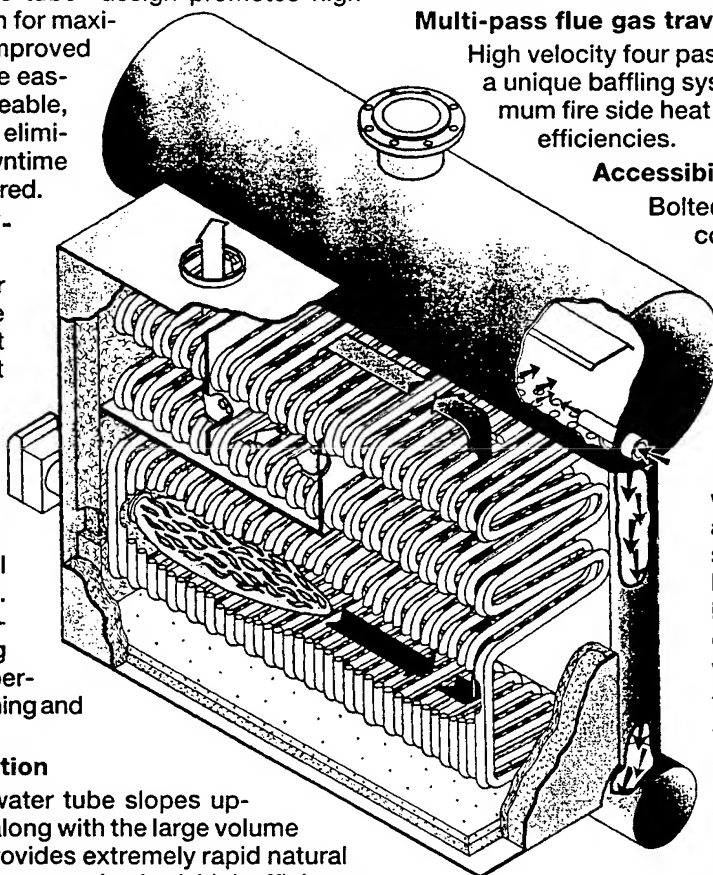
Bolted inner panel provides easy and complete access to furnace and boiler tube area, as well as to burner head. Tube side panels are all removable and heavily insulated and sealed to boiler frame. All access is from only one side.

Large steam drum

The steam drum has generous water volume and steam release area. This design, along with specially engineered steam baffles, results in a stable water level and produces extremely dry steam at all load conditions.

Water cooled furnace

The configuration of the water tubes provides a water cooled combustion chamber. A high percentage of the heating surface is exposed to direct radiant heat, increasing water velocities and heat transfer.



Select a model to precisely meet your needs

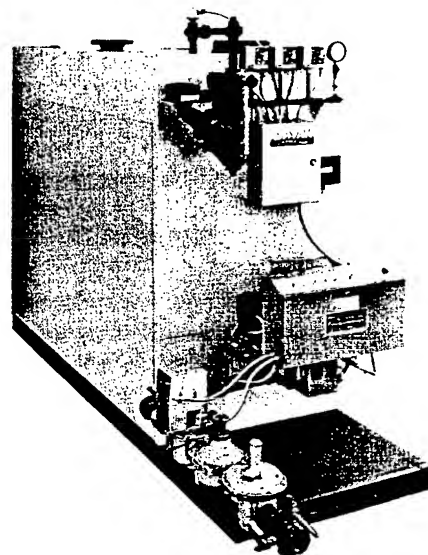
Boiler Model	Input MBH (kW)	Steam Output Pounds per Hour*	Nominal Boiler Horsepower**
AB-90-S	900 (263.7)	742	22
AB-120-S	1200 (351.6)	989	30
AB-150-S	1500 (439.5)	1237	37
AB-200-S	2000 (586)	1649	49
AB-250-S	2500 (732.5)	2061	62

* from and at 212°F

** Natural gas, low pressure

Bryan flexible water tube boilers are ideally suited for a wide range of commercial and industrial uses, space heating and process applications.

Note: Boilers are not approved for installation on combustible floors.

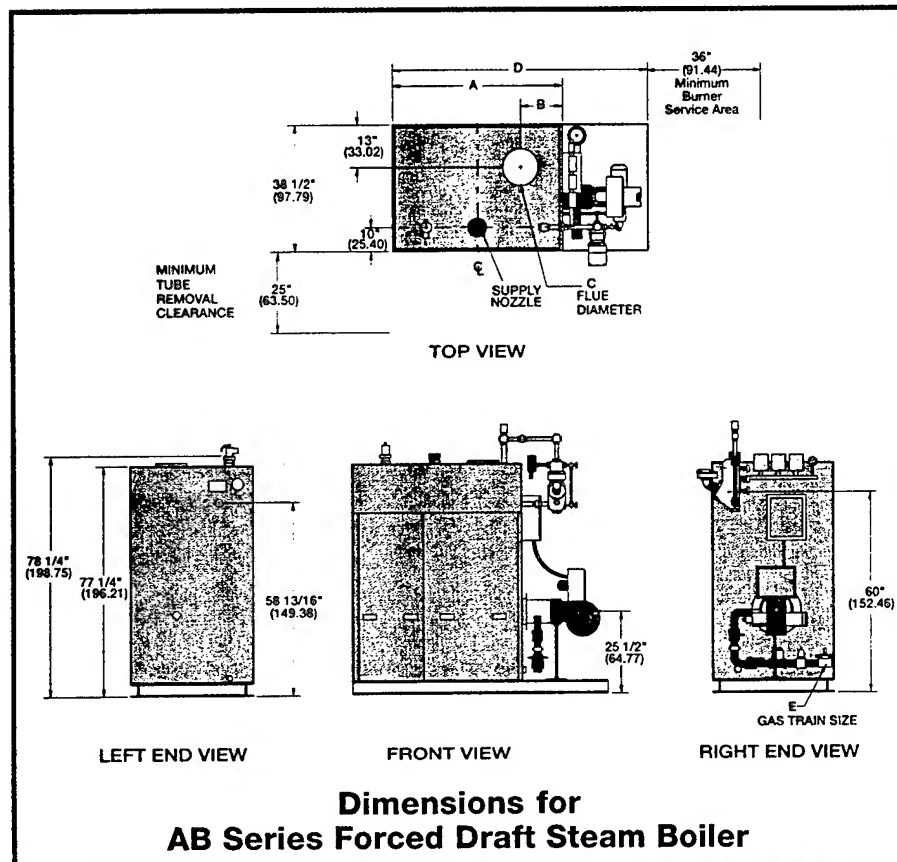
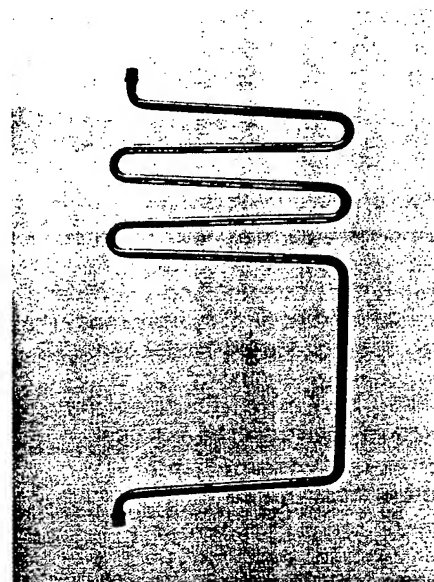


The Bryan "Flexible Water Tube" Story

Bryan Steam Corporation is proud of its history of developing and producing the original "Flexible Tube" boiler. During nine decades beginning in 1916 over five million of these tubes have been installed. The shape of this design gives the tube resilience and a natural upward flow which combine to de-

liver its unique benefits in Bryan boilers.

- Promotes rapid internal water circulation for efficient heat transfer
- Is easily replaced or removed without welding or rolling
- Requires a minimum of service space



Boiler Model	AB 90	AB 120	AB 150	AB 200	AB 250
A-Length over Jacket	44" (111.76)	53" (134.62)	62 1/2" (158.75)	78" (198.12)	93" (237.49)
B-Flue Location	13 1/2" (34.29)	13 1/2" (34.29)	17 1/2" (44.45)	17 1/2" (44.45)	17 1/2" (44.45)
C-Flue Diameter	10" (25.40)	10" (25.40)	10" (25.40)	10" (25.40)	12" (30.48)
D-Overall Length	76" (193.04)	85 3/8" (216.83)	94 3/4" (240.66)	110" (279.40)	125 1/2" (318.77)
E-Gas Train Size	1 1/4" (3.18)	1 1/4" (3.18)	1 1/4" (3.18)	2" (5.08)	2" (5.08)

Specifications subject to change without notice. Consult factory to consult on other boiler options.

Standard Equipment Furnished

Forced draft - flame retention type burner (gas, oil or gas/oil), complete with the latest state-of-the-art programming and safety combustion controls, pressure gauge, operating limit safety control, low water cut-off, pump control, auxiliary probe type LWCO, ASME safety relief valve, all controls installed and wired.

Optional Equipment Available

Manual reset high limit pressure control, two stage or modulating firing controls, dual fuel gas burner (example: natural and propane), alarm bells, FM, IRI or other insurance-approved control systems, indicating lights as desired, condensate return and boiler feed systems, water softeners, boiler and control blow-down assembly, higher operating pressures and temperatures available, auxiliary electric steam superheaters to 700°F. Contact factory for additional options and special construction including low NO_x package.

BRYAN STEAM CORPORATION

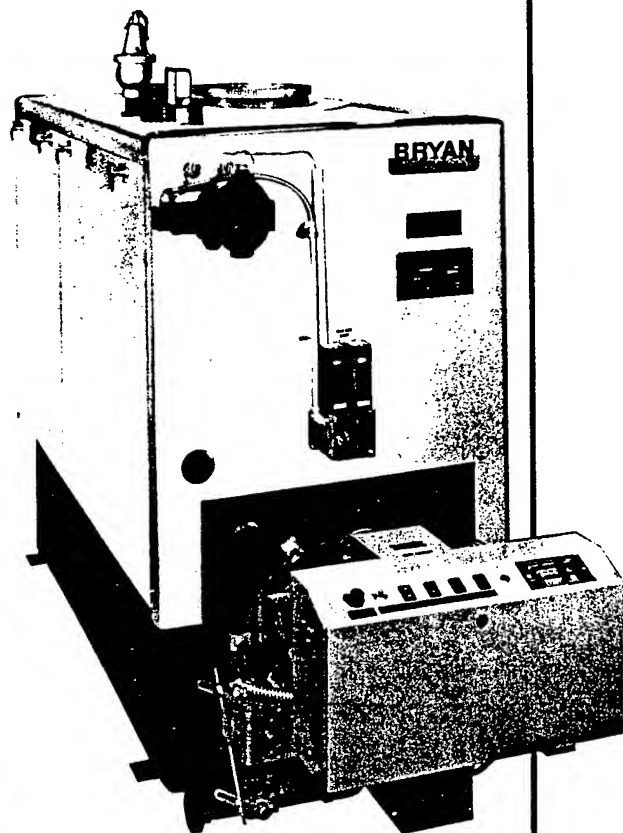
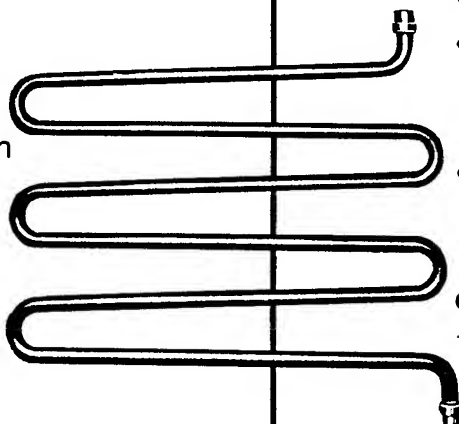
P.O. Box 27, Peru, Indiana 46970 Telephone: 317-473-6651
Fax: 317-473-3074



Forced Draft Gas Bryan HECL Series Flexible Tube Boilers

Hot Water Heating 750,000 to 3,000,000 BTU's

HECL Series Boilers combine the time-proven Bryan Flexible Water Tube with an innovative heat extractor design.



Bryan Boilers are designed and built to the requirements of the appropriate A.S.M.E. boiler code. Boilers not approved for installation on combustible floor.

Guaranteed 85% efficiency

- With HECL Series Boilers, you get a guaranteed 85% combustion efficiency resulting from a uniquely designed integrated extended surface heat extractor.
- What's more, HECL Boilers offer high operating efficiency—at all normal operation temperatures—without the complications of condensation concerns.

Construction Features

1. Heavy steel boiler frame, built and stamped in accordance with the A.S.M.E. boiler code. Constructed as standard for hot water operating pressures to 60 psi.
2. Water leg downcomers to insure rapid internal circulation and temperature equalization.
3. Bryan bent water tubes, flexible, easily replaceable, requiring no welding or rolling.
4. Access panels, interior of boiler easily accessible for service and inspection.
5. Boiler tube access panel bolted tightly and sealed to boiler frame. Constructed of high temperature insulation board and steel framework. Tubes installed from one side.
6. Boiler frame insulated with 1-1/2" thick insulating refractory.
7. Boiler jacket, heavy gauge, zinc-coated, rust resistant primer and attractive enamel.
8. Flange mounted, gun type burner with flame retention head. Forced draft.
9. Lightweight, high temperature insulating fire brick combustion chamber—insulated from floor.
10. All controls installed and wired.

Specifications

BOILER MODEL NUMBER	Firing Rate	Gross Output		Net Load Recommendation (EDR)		Approx. Shipping Weight
	BTU's Per Hour	BTU's Per Hour	Boiler Horse-Power	BTU's Per Hour	Hot Water Radiation Sq Ft	
HECL-75	750,000	637,500	19	554,000	3,690	1,830
HECL-90	900,000	765,000	23	665,000	4,430	2,150
HECL-120	1,200,000	1,020,000	30	887,000	5,910	2,400
HECL-150	1,500,000	1,275,000	38	1,109,000	7,390	2,700
HECL-180	1,800,000	1,530,000	46	1,330,000	8,870	3,000
HECL-210	2,100,000	1,785,000	53	1,552,000	10,350	3,400
HECL-240	2,400,000	2,040,000	61	1,774,000	11,830	3,600
HECL-270	2,700,000	2,295,000	69	1,996,000	13,310	3,900
HECL-300	3,000,000	2,550,000	76	2,217,000	14,780	4,200

Bryan HECL Series Gas Flexible Tube Boilers

Efficient Water Tube Design

The Bryan Flexible Water Tube provides for extremely fast internal circulation for maximum heat transfer and operating efficiency.

No "Thermal Shock"

The flexibility of the bent water tube design eliminates all possible damage from "Thermal Shock" and from stresses caused by poor or unequal internal circulation. This is particularly important with forced hot water heating systems designed for higher temperatures and greater temperature drops.

Natural Internal Circulation

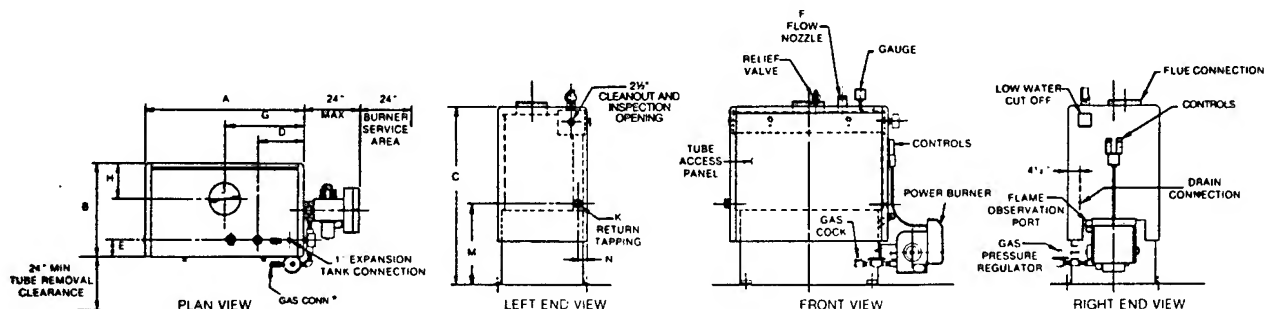
The water tube design and the large downcomer water legs provide adequate internal circulation without concern over exterior pumping conditions. Low pressure drop through boiler.

Compact—Minimum Floor Space

Requires less floor space than most boilers—minimum boiler room size.

Shipped completely assembled and wired.

Tubes are easily removable and replaceable, requiring little service space.



DIMENSIONS (in inches)

BOILER MODEL	Length Over Jacket	Width Over Jacket	Height Over Jacket	Location of Flow Nozzle or Tapping		Flow Nozzle Or Tapping NPT	Location of Flue Connection		Flue Diameter	Return Tapping NPT	Location of Return Tapping	
	A	B	C	D	E	F	G	H	J	K	M	N
HECL-75	36¼	34½	66½	17	6¼	3	18⅞	16	8	3	30¼	4½
HECL-90	41½	34½	66½	17	6¼	3	20¾	15	10	3	30¼	4½
HECL-120	50¾	34½	66½	17	6¼	3	25⅞	14	10	3	30¼	4½
HECL-150	59¾	34½	66½	17	6¼	3	29⅞	13	12	3	30¼	4½
HECL-180	69	34½	66½	17	6¼	3	34½	12	14	3	30¼	4½
HECL-210	78¼	34½	66½	17	6¼	3	39⅞	12	14	3	30¼	4½
HECL-240	87½	34½	66½	17	6¼	3	43¾	11	16	3	30¼	4½
HECL-270	96¾	34½	66½	17	6¼	3	48⅞	11	16	3	30¼	4½
HECL-300	106	34½	66½	17	6¼	3	53	11	16	3	30¼	4½

*Gas train and control location dimensions will vary depending on job specifications and conditions.

NOTE: Dimensions and specifications are subject to change without notice. Consult factory for certified dimensions.

Standard Equipment

Forced draft construction, combination thermometer and altitude gauge, A.S.M.E. rated relief valve, combustion safety control, high limit control, low water cut-off, built-in combustion chamber, flange-mounted burner, electronic combustion safety control, water temperature control (240° max. std.) heavy gauge jacket with 1½" insulation. All controls mounted and wired.

Optional Equipment

1. Combination water feeder and low water cut-off.
2. Induced draft fan.

When ordering, please specify

- (1) Electric power voltage and frequency (115v-60Hz is std.)
- (2) Relief valve setting.
- (3) Optional equipment or special features.

BRYAN STEAM CORPORATION

P.O. Box 27, Peru, Indiana 46970 / Telephone: 317-473-6651

FAX: 317-473-3074

BUILDING 741 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	184.55	131.11	53.44	213.45
Annual Natural Gas (MBTU)	1010.13	853.47	156.66	625.73
Electric Demand June (KW)	14.26	14.26	0.00	0.00
Electric Demand July (KW)	14.26	14.26	0.00	0.00
Electric Demand August (KW)	14.26	14.26	0.00	0.00

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8300 (sq.ft.)	8640
ECO Model Bldg 741 (sq.ft.)	34510
Square Footage Adjustment Factor	3.994

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 741 - Replace STM UHs w/ Gas-fired Infrared Tube Heating System

A. CONSTRUCTION COST	=	\$145,945
B. SIOH COST	(5.5% of 1A) =	\$8,027
C. DESIGN COST	(6.0% of 1A) =	\$8,757
D. TOTAL COST	(1A + 1B + 1C) =	\$162,728
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$20,500
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$142,228

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	213	\$2,583	15.88	\$41,014
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	626	\$2,578	18.30	\$47,178
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$0	14.88	\$0
F. TOTAL		839	\$5,161		-----> \$88,192

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	\$600	14.88	\$8,921
2		\$0	14.88	\$0
3		\$0	14.88	\$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$600		\$8,921

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	\$63,690	5	0.863	\$54,964
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$63,690			\$54,964

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$63,885

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$8,945
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	15.90
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$152,077
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.07

ENGINEER'S OPINION OF PROBABLE COST

PROJECT Fort Riley Feasibility Study for HVAC Upgrade

ENGINEER E M C Engineers, Inc.

Denver, CO

SHEET 1 OF 1

DATE PREPARED 4-May-95

ESTIMATOR C. Wohler

CHECKED BY A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 741							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5	STLPIP3	STEEL PIPE SCH. 40, 3" W/HANGERS	L.F.	50.0	\$6.40	\$320	Q-15	0.372	\$361
6	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	400.0	\$5.28	\$2,112	Q-15	0.34	\$2,637
7	STLPIP1.2	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	375.0	\$2.56	\$959	Q-1	0.2	\$1,454
8	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	65.0	\$2.10	\$137	Q-1	0.151	\$190
9	GASCN	FLEXIBLE CONNECTOR 12" LONG	EA.	40.0	\$7.90	\$316	1-PLUM	0.222	\$191
10	IRHEAT	GAS FIRED IR TUBE SYSTEMS / BURNER	EA.	36.0	\$1,564.94	\$56,338	Q-6	18.24	\$13,202
11	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	850.0	\$0.83	\$708	1-ELEC	0.064	\$1,138
12	WIRE#6	COPPER WIRING #6	C.L.F.	8.5	\$24.71	\$210	1-ELEC	1.231	\$219
13	FURN150	PULSE COMB FURNACE 150,000 BTUH	EA.	2.0	\$2,713.20	\$5,426	Q-10	28	\$1,088
14	FURN125	PULSE COMB FURNACE 125,000 BTUH	EA.	1.0	\$2,422.50	\$2,423	Q-10	26	\$505
15	UH7	HORIZ. UNIT HEATER, PROPELLER, 87.6 MBH	EA.	1.0	\$731.60	\$732	Q-5	2.462	\$48
16									
17									
18									
19									
20									
21		EXISTING SYSTEMS DEMOLITION							
22		BOILER DEMOLITION (Salv Value = \$20,500)	EA.	1.0		\$69,681	Q-6	150	\$3,016
23		UNIT HEATER & BASEBOARD DEMO	TON	3.3		\$11,706	Q-5	14.545	\$931
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$69,681			\$24,981
32	OH	OVERHEAD			17%	\$11,706			\$4,197
33	PRO	PROFIT			10%	\$8,139			\$2,918
34	CONT	CONTINGENCY			20%	\$17,905			\$6,419
35		TOTAL COST				\$107,431			\$38,514
									\$94,661
									\$15,903
									\$11,056
									\$24,324
									\$145,945

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET 1 OF 1		DATE PREPARED 4-May-95		ESTIMATOR C. Wohliert		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 741							
2		NON-RECURRING							
3									
4									
5	AHU14000	BASELINE - EXISTING EQUIP. REPLACEMENT	EA.	4.0	\$6,492.30	\$25,969	Q-6	57.143	\$4,596
6	DUCT100	14,000 CFM AHU, HEATING ONLY	LB.	800.0	\$0.47	\$372	Q-10	0.094	\$1,461
7	STLPIP1.5	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	L.F.	120.0	\$2.95	\$353	Q-1	0.2	\$465
8	UH7	STEEL PIPE SCH. 40, 1.5" W/HANGERS	EA.	4.0	\$731.60	\$2,926	Q-5	2.462	\$191
9	BBRD36	HORIZ. UNIT HEATER, PROPELLER, 87.6 MBH	EA.	4.0	\$605.63	\$2,423	Q-5	2	\$155
10	STLPIP1	CAST IRON RADIATOR, 36.5 MBH	L.F.	80.0	\$2.10	\$168	Q-1	0.151	\$234
11	INSLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	80.0	\$0.62	\$50	Q-14	0.073	\$108
12	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	120.0	\$1.40	\$167	Q-14	0.08	\$177
13									
14									
15									
16									
17									
18									
19									
20		EXISTING SYSTEMS DEMOLITION							
21		AHU DEMOLITION	TON	1.8			Q-6	12	\$434
22		UNIT HEATER & BASEBOARD DEMO	TON	3.3			Q-5	14.545	\$931
23		PIPING DEMOLITION	L.F.	200.0			PLUM	0.04	\$129
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$32,429			\$8,881
32	OH	OVERHEAD			17%	\$5,448			\$1,492
33	PRO	PROFIT			10%	\$3,788			\$1,037
34	CONT	CONTINGENCY			20%	\$8,333			\$2,282
35	TOTAL COST					\$49,998			\$13,692
									\$41,310
									\$6,940
									\$4,825
									\$10,615
									\$63,690

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT				Fort Riley Feasibility Study for HVAC Upgrade		SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER				E M C Engineers, Inc. Denver, CO		ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 741							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	\$96.90	Q-6	25	\$503	\$600
5	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.	15.0		Q-6	4	\$1,206	\$1,206
6	MNT-AHU	MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.	4.0	\$0.00	Q-6	25	\$2,011	\$2,011
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	-	-	\$3,720	\$3,816
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17									
18									
19	MNT-IR	MAINT. ON IR HEATERS - INSPEC. / YR	EA.	36.0		Q-6	4	\$2,895	\$2,895
20	MNT-FAC	MAINT. ON FAC - INSPEC. / YR	EA.	3.0	\$0.00	Q-6	4	\$241	\$241
21	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.	1.0	\$0.00	Q-6	4	\$80	\$80
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	-	-	\$3,217	\$3,217
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	-	-	\$503	\$600



EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176-74/ VEHICAL MAINT BAY
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 4 RECTANGULAR 4 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - -			- - - - W A L L - - - -			- W A L L + G L A S S -			AZIMUTH
		U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)		
	BAY-AREA	0.000	0.00	0.133	3600.00	0.133	3600.00	0.133	3600.00	NORTH-EAST	
	BAY-AREA	0.490	56.00	0.133	3544.00	0.139	3600.00	0.139	3600.00	SOUTH-WEST	
	BAY-AREA	0.490	266.00	0.133	1234.00	0.196	1500.00	0.196	1500.00	NORTH-WEST	
	BAY-AREA	0.000	0.00	0.092	7440.00	0.092	7440.00	0.092	7440.00	ROOF	
	BAY-AREA	0.000	0.00	0.020	7440.00	0.020	7440.00	0.020	7440.00	UNDERGRND	

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

D 8-7

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/7/1995 13:23: 7 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7776 74/ VEHICAL MAINT BAY
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 8640 SQFT 803 SQMT
VOLUME 216000 CUFT 6117 CUMT

COOLING LOAD

TIME SEP 6 4PM
DRY-BULB TEMP 93F 34C
WET-BULB TEMP 76F 24C

HEATING LOAD

DEC 8 1PM
20F -7C
17F -8C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	20.461	5.993	0.000	0.000	-33.326	-9.760
ROOFS	21.857	6.401	0.000	0.000	-30.484	-8.928
GLASS CONDUCTION	3.833	1.122	0.000	0.000	-7.984	-2.338
GLASS SOLAR	8.789	2.574	0.000	0.000	3.614	1.058
DOOR	19.780	5.793	0.000	0.000	-28.776	-8.428
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.055	-0.016	0.000	0.000	-2.656	-0.778
OCCUPANTS TO SPACE	8.857	2.594	17.500	5.125	8.670	2.539
LIGHT TO SPACE	36.907	10.809	0.000	0.000	35.571	10.418
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	507.805	148.723	647.265	189.568	-1265.722	-370.698
TOTAL	628.234	183.994	664.765	194.693	-1321.092	-386.915
TOTAL LOAD	1292.998	KBTU/H	378.687	KW	-1321.092	KBTU/H
TOTAL LOAD / AREA	149.65	BTU/H.SQFT	471.777	W /SQMT	152.904	BTU/H.SQFT

*
* NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* --- LOADS *
* 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #1176 741 VEHICAL MAINT BAY
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR UNIT-HEATS TOPEKA, KS

MONTH	COOLING				MAXIMUM COOLING LOAD (KBTU/HR)	HEATING				MAXIMUM HEATING LOAD (KBTU/HR)	ELEC	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-152.395	4 10	8.F	7.F	-1153.493	2975.	15.141
FEB	0.00000				0.000	-108.869	14 10	30.F	27.F	-972.041	2666.	15.141
MAR	0.00000				0.000	-94.123	3 9	17.F	13.F	-1117.751	3194.	15.141
APR	0.00000				0.000	-34.033	4 10	34.F	31.F	-860.876	2871.	15.030
MAY	0.00000				0.000	-5.651	4 17	55.F	53.F	-397.961	2847.	14.560
JUN	0.00000				0.000	0.000				0.000	2978.	14.250
JUL	0.00000				0.000	0.000				0.000	2708.	14.250
AUG	0.00000				0.000	0.000				0.000	3114.	14.250
SEP	0.00000				0.000	0.000				0.000	2843.	14.250
OCT	0.00000				0.000	-24.799	19 11	39.F	32.F	-750.751	2728.	14.920
NOV	0.00000				0.000	-64.337	1 15	36.F	28.F	-889.781	2762.	15.062
DEC	0.00000				0.000	-140.368	8 13	20.F	17.F	-1187.388	2964.	15.141
TOTAL	0.000					-624.576					34649.	
MAX					0.000					-1187.388		15.141

D89

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #1176 VEHICAL MAINT BAY
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR UNIT-HEATS TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING LOAD	HEATING LOAD	COOL-HEAT LOAD	COINCIDENT HOURS	COOLING AVAIL.	HEATING AVAIL.	FANS ON CYCLE	FANS ON VENTING	COOLING PEAK (KBTU/HR)	HEATING PEAK (KBTU/HR)	COOLING PEAK (KW)	HEATING PEAK (KW)
JAN	0	384	0	0	360	744	0	384	0	0	0.169	0.169
FEB	0	336	0	0	336	672	0	336	0	0	0.169	0.169
MAR	0	370	0	0	374	744	0	370	0	0	0.215	0.215
APR	0	231	0	0	489	720	0	278	0	47	0.031	0.031
MAY	0	62	0	0	682	360	0	194	0	132	0.000	0.000
JUN	0	0	0	0	720	0	0	0	0	0	0.000	0.000
JUL	0	0	0	0	744	0	0	0	0	0	0.000	0.000
AUG	0	0	0	0	744	0	0	0	0	0	0.000	0.000
SEP	0	0	0	0	720	0	0	0	0	0	0.000	0.000
OCT	0	212	0	0	532	720	0	272	0	60	0.000	0.000
NOV	0	330	0	0	390	720	0	333	0	3	0.000	0.000
DEC	0	382	0	0	362	744	0	382	0	0	0.000	0.000
ANNUAL	0	2307	0	0	6453	5424	0	2549	0	242		

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY 23.163 88.871 27/16	NATURAL-GAS 238.950 1543.960 4/10
JAN	TOTAL(MBTU) PEAK(KBTU) DY/HR	20.113 88.871 14/10	177.244 1337.701 14/10
FEB	TOTAL(MBTU) PEAK(KBTU) DY/HR	21.488 88.871 3/11	154.397 1503.793 57.420
MAR	TOTAL(MBTU) PEAK(KBTU) DY/HR	14.927 88.493 4/10	1208.451 4/10
APR	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.891 86.888 4/11	9.920 646.644 4/17
MAY	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.169 48.656 30/16	0.000 0.000 30/ 1
JUN	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.245 48.656 29/16	0.000 0.000 31/ 1
JUL	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.631 48.656 31/16	0.000 0.000 31/ 1
AUG	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.707 48.556 30/16	0.000 0.000 30/ 1
SEP	TOTAL(MBTU) PEAK(KBTU) DY/HR	13.577 88.116 19/11	42.222 1078.248 19/11
OCT	TOTAL(MBTU) PEAK(KBTU) DY/HR	17.870 88.604 1/15	107.824 1242.270 1/15
NOV	TOTAL(MBTU) PEAK(KBTU) DY/HR	22.764 88.871 30/14	222.157 1581.841 8/13
DEC	TOTAL(MBTU) PEAK(KBTU) DY/HR	184.545 88.871	1010.134 1581.841
	ONE YEAR USE/PEAK		

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #11674/ VEHICAL MAINT BAY
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	40.84	1010.13
SPACE COOL	0.00	0.00
HVAC AUX	27.22	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	116.48	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	184.55	1010.13

TOTAL SITE ENERGY 1194.68 MBTU 114.1 KBTU/SQFT-YR GROSS-AREA 138.3 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1564.32 MBTU 149.3 KBTU/SQFT-YR GROSS-AREA 181.1 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 8.3
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/9/1995 16:16:54 SDL RUN 1
 DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #1176-74 VEHICAL MAINT BAY
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR GAS_IR TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)		
JAN	0.00000			0.000	-161.324	14 9	-3.F -4.F	-1209.730	2843.	14.250		
FEB	0.00000			0.000	-114.568	14 10	30.F 27.F	-775.229	2572.	14.250		
MAR	0.00000			0.000	-95.488	3 8	15.F 12.F	-989.212	3114.	14.250		
APR	0.00000			0.000	-29.269	4 10	34.F 31.F	-672.389	2843.	14.250		
MAY	0.00000			0.000	-3.843	5 8	46.F 41.F	-233.841	2843.	14.250		
JUN	0.00000			0.000	0.000			0.000	2978.	14.250		
JUL	0.00000			0.000	0.000			0.000	2708.	14.250		
AUG	0.00000			0.000	0.000			0.000	3114.	14.250		
SEP	0.00000			0.000	0.000			0.000	2843.	14.250		
OCT	0.00000			0.000	-21.190	19 10	38.F 34.F	-582.407	2708.	14.250		
NOV	0.00000			0.000	-64.499	30 8	28.F 25.F	-638.875	2708.	14.250		
DEC	0.00000			0.000	-146.027	8 13	20.F 17.F	-1193.378	2843.	14.250		
TOTAL	0.000			0.000	-636.209			-1209.730	34115.	14.250		
MAX												

D8-12

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/9/1995 16:16:54 SDL RUN 1
 DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #1176 VEHICAL MAINT BAY
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR GAS_IR TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING LOAD	HOURS HEATING LOAD	COOL-HEAT LOAD	COINCIDENT HOURS	COOLING AVAIL.	HEATING AVAIL.	COOLING AVAIL.	HEATING AVAIL.	ELEC- TRICAL LOAD	MAXIMUM ELEC LOAD		
JAN	0	744	0	0	744	744	744	744	-97.173	0.000		
FEB	0	671	0	1	672	672	672	672	-96.123	0.000		
MAR	0	710	0	34	744	744	744	744	-96.846	0.000		
APR	0	325	0	395	720	720	720	720	0.000	0.000		
MAY	0	76	0	668	360	360	360	360	0.000	0.000		
JUN	0	0	0	720	0	0	0	0	0.000	0.000		
JUL	0	0	0	744	0	0	0	0	0.000	0.000		
AUG	0	0	0	744	0	0	0	0	0.000	0.000		
SEP	0	0	0	720	0	0	0	0	0.000	0.000		
OCT	0	290	0	454	720	720	720	720	-68.154	0.000		
NOV	0	580	0	140	720	720	720	720	-107.993	0.000		
DEC	0	743	0	1	744	744	744	744	-107.135	0.000		
ANNUAL	0	4139	0	4621	5424	5424	8760	5424	0	1285		

EMC ENGINEERS INC. 80227 E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 PDL RUN 1
 DENVER, CO PROPOSED UP-GRADE FOR BLDG. #4474 VEHICAL MAINT BAY
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY 13.417 76.480 14/ 9	NATURAL-GAS 207.320 1342.800 14/ 9
JAN	TOTAL(MBTU) PEAK(KBTU) DY/HR	11.417 66.486 14/10	152.426 904.349 14/10
FEB	TOTAL(MBTU) PEAK(KBTU) DY/HR	12.827 71.408 3/ 8	130.745 1125.162 3/ 8
MAR	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.380 64.121 4/10	42.944 794.853 4/10
APR	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.795 54.034 5/ 8	6.521 303.345 5/ 8
MAY	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.169 48.656 30/16	0.000 0.000 30/ 1
JUN	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.245 48.656 29/16	0.000 0.000 31/ 1
JUL	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.631 48.656 31/16	0.000 0.000 31/ 1
AUG	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.707 48.656 30/16	0.000 0.000 30/ 1
SEP	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.732 62.051 19/10	32.516 697.252 19/10
OCT	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.728 63.350 30/ 8	91.211 758.697 30/ 8
NOV	TOTAL(MBTU) PEAK(KBTU) DY/HR	13.065 76.103 8/13	189.783 1327.008 8/13
DEC	TOTAL(MBTU) PEAK(KBTU) DY/HR		
	ONE YEAR USE/PEAK	131.115 76.480	853.466 1342.800

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOB-2.1D 2/ 9/1995 16:16:54 PDL RUN 1
 DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #1170-741 VEHICAL MAINT BAY
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE		
IN SITE MBTU -	ELECTRICITY	NATURAL-GAS
CATEGORY OF USE		
SPACE HEAT	0.00	853.47
SPACE COOL	0.00	0.00
HVAC AUX	14.63	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	116.48	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	131.11	853.47

TOTAL SITE ENERGY 984.58 MBTU 94.0 KBTU/SQFT-YR GROSS-AREA 114.0 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1247.20 MBTU 119.1 KBTU/SQFT-YR GROSS-AREA 144.4 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 820 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	141.02	129.27	11.75	10.96
Annual Natural Gas (MBTU)	490.89	379.78	111.11	103.65
Electric Demand June (KW)	14.26	14.26	0.00	0.00
Electric Demand July (KW)	14.26	14.26	0.00	0.00
Electric Demand August (KW)	14.26	14.26	0.00	0.00

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8300 (sq.ft.)	8640
ECO Model Bldg 820 (sq.ft.)	8060
Square Footage Adjustment Factor	0.933

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005	
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995	
ANALYSIS DATE:	03/07/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohler

1. INVESTMENT: BLDG 820 - Replace HW UHs w/ Gas-fired Infrared Tube Heating System

A. CONSTRUCTION COST	=	\$42,553
B. SIOH COST	(5.5% of 1A) =	\$2,340
C. DESIGN COST	(6.0% of 1A) =	\$2,553
D. TOTAL COST	(1A + 1B + 1C) =	\$47,446
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$9,900
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$37,546

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	11	\$133	15.88	\$2,106
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	104	\$427	18.30	\$7,815
D. COAL	\$0.00	0	\$0	16.62	\$0
E. DEMAND (KW)	\$4.20	0	\$0	14.88	\$0
F. TOTAL		115	\$560		-----> \$9,921

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	\$370	14.88	\$5,508
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$370		\$5,508

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	\$43,700	5	0.863	\$37,713
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$43,700			\$37,713

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$43,221

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$3,115
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	12.05
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$53,141
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	1.42

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST

PROJECT Fort Riley Feasibility Study for HVAC Upgrade
ENGINEER E M C Engineers, Inc.
Denver, CO

SHEET 1 OF 1
DATE PREPARED 1-Mar-95
ESTIMATOR C. Wohler
CHECKED BY A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 820								
2		PROPOSED SYSTEM MODIFICATIONS								
3		NEW SYSTEMS INSTALLATION								
4		STEEL PIPE SCH. 40, 2" WHANGERS	L.F.	150.0	\$3.91	\$587	Q-1	0.25	\$727	\$1,314
5	STLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	150.0	\$1.46	\$219	Q-14	0.084	\$232	\$452
6	INSLPIP2	STEEL PIPE SCH. 40, 1.5" WHANGERS	L.F.	40.0	\$2.95	\$118	Q-1	0.2	\$155	\$273
7	STLPIP1.5	STEEL PIPE SCH. 40, 1.25" WHANGERS	L.F.	70.0	\$2.56	\$179	Q-1	0.2	\$271	\$451
8	STLPIP1.2	STEEL PIPE SCH. 40, 0.75" WHANGERS	L.F.	4.0	\$1.51	\$6	1-PLUM	0.2	\$17	\$23
9	STLPIP0.7	STEEL PIPE SCH. 40, 0.5" WHANGERS	L.F.	80.0	\$1.33	\$106	1-PLUM	0.2	\$345	\$451
10	STLPIP0.5	1.613 MBH HOT WATER BOILER	EA.	1.0	\$9,786.90	\$9,787	Q-7	76.19	\$1,566	\$11,353
11	HWBLR2	GAS FIRED IR TUBE SYSTEMS / BURNER	EA.	6.0	\$1,564.94	\$9,390	Q-6	18.24	\$2,200	\$11,590
12	IRHEAT	ELECTRICAL CONDUIT 1"	L.F.	200.0	\$0.83	\$167	1-ELEC	0.064	\$268	\$435
13	ELCND1	COPPER WIRING #6	C.L.F.	3.0	\$24.71	\$74	1-ELEC	1.231	\$77	\$151
14	WIRE#6	FLEXIBLE CONNECTOR 12" LONG	EA.	6.0	\$7.90	\$47	1-PLUM	0.222	\$29	\$76
15	GASCN									
16										
17		EXISTING SYSTEMS DEMOLITION								
18		BOILER DEMOLITION (Salv Value = \$7,000)	EA.	1.5			Q-6	12	\$362	\$362
19		UNIT HEATER DEMOLITION (Salv Value = \$2,900)	TON	1.0			Q-5	14.545	\$282	\$282
20		HW PIPING DEMOLITION	L.F.	450.0			1-PLUM	0.04	\$388	\$388
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		SUBTOTAL				\$20,681			\$6,919	\$27,600
32	OH	OVERHEAD			17%	\$3,474			\$1,162	\$4,637
33	PRO	PROFIT			10%	\$2,415			\$808	\$3,224
34	CONT	CONTINGENCY			20%	\$5,314			\$1,778	\$7,092
35		TOTAL COST				\$31,884			\$10,668	\$42,553

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT				SHEET 1 OF 1			DATE PREPARED 15-Mar-95		
ENGINEER				Fort Riley Feasibility Study for HVAC Upgrade			ESTIMATOR C. Wohler		
				E M C Engineers, Inc.			CHECKED BY A. Niemeyer		
				Denver, CO					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 820							
2		NON-RECURRING							
3									
4		BASELINE - EXISTING EQUIP. REPLACEMENT							
5	HWBLR3	2,312 MBH HOT WATER BOILER	EA.	1.0	\$14,051	\$14,051	Q-7	88.889	\$1,827
6	STLPIP2	STEEL PIPE SCH. 40, 2" WHANGERS	L.F.	450.0	\$3.91	\$1,762	Q-1	0.25	\$2,181
7	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	450.0	\$1.46	\$658	Q-14	0.084	\$696
8	UH7	HORIZ. UNIT HEATER, PROPELLER, 87.6 MBH	EA.	8.0	\$731.60	\$5,853	Q-5	2.462	\$382
9									
10									
11									
12									
13		EXISTING SYSTEMS DEMOLITION							
14		BOILER DEMOLITION	EA.	1.5			Q-6	12	\$362
15		UNIT HEATER DEMOLITION	TON	1.0			Q-5	14.545	\$282
16		HW PIPING DEMOLITION	L.F.	450.0			PLUM	0.04	\$290
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$22,323			\$6,021
32	OH	OVERHEAD			17%	\$3,750			\$1,012
33	PRO	PROFIT			10%	\$2,607			\$703
34	CONT	CONTINGENCY			20%	\$5,736			\$1,547
35	TOTAL COST					\$34,417			\$9,283
									\$28,344
									\$4,762
									\$3,311
									\$7,283
									\$43,700

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 1-Mar-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohlerl		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 820							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	\$96.90	\$97	Q-6	25	\$503
5	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.	8.0			Q-6	4	\$643
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$97	-	-	\$1,146
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17		MAINT. ON BOILERS - <2.5 MBH	EA.	1.0	\$48.45	\$48	Q-6	17	\$342
18	MNT-BLR	MAINT. ON IR HEATERS - INSPEC. / YR	EA.	6.0			Q-6	4	\$483
19	MNT-IR								
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$48	-	-	\$824
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$48	-	-	\$322
									\$370



EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 4 RECTANGULAR 4 OTHER 0
 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS			WALL			GLASS			AZIMUTH
		U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AVERAGE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AVERAGE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AVERAGE (BTU/HR-SQFT-F)	
BAY-AREA		0.000	0.00	0.133	0.133	3600.00	0.133	0.133	3600.00	0.133	NORTH-EAST
BAY-AREA		0.490	56.00	0.133	0.133	3544.00	0.133	0.133	3600.00	0.133	SOUTH-WEST
BAY-AREA		0.490	266.00	0.133	0.133	1234.00	0.133	0.133	1500.00	0.133	NORTH-WEST
BAY-AREA		0.000	0.00	0.092	0.092	7440.00	0.092	0.092	7440.00	0.092	ROOF
BAY-AREA		0.000	0.00	0.020	0.020	7440.00	0.020	0.020	7440.00	0.020	UNDERGRND

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

D 21

	AVERAGE		AVERAGE		AVERAGE		GLASS		OPAQUE		GLASS+OPAQUE	
	U-VALUE (BTU/HR-SQFT-F)	U-VALUE/GLASS (BTU/HR-SQFT-F)	U-VALUE/WALLS (BTU/HR-SQFT-F)	U-VALUE/WALLS+GLASS (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	GLASS+GLASS (BTU/HR-SQFT-F)	GLASS (SQFT)	GLASS (SQFT)	OPAQUE (SQFT)	OPAQUE (SQFT)	GLASS+OPAQUE (SQFT)	GLASS+OPAQUE (SQFT)
NORTH-EAST	0.000	0.133	0.133	0.133	0.133	0.133	0.00	0.00	3600.00	3600.00	3600.00	3600.00
SOUTH-WEST	0.490	0.133	0.133	0.133	0.139	0.139	56.00	56.00	3544.00	3600.00	3600.00	3600.00
NORTH-WEST	0.490	0.133	0.133	0.133	0.196	0.196	266.00	266.00	1234.00	1500.00	1500.00	1500.00
ROOF	0.000	0.092	0.092	0.092	0.092	0.092	0.00	0.00	7440.00	7440.00	7440.00	7440.00
ALL WALLS	0.490	0.133	0.133	0.133	0.146	0.146	322.00	322.00	8378.00	8700.00	8700.00	8700.00
WALLS+ROOFS	0.490	0.114	0.114	0.114	0.121	0.121	322.00	322.00	15818.00	16140.00	16140.00	16140.00
UNDERGRND	0.000	0.020	0.020	0.020	0.020	0.020	0.00	0.00	7440.00	7440.00	7440.00	7440.00
BUILDING	0.490	0.084	0.084	0.084	0.089	0.089	322.00	322.00	23258.00	23580.00	23580.00	23580.00

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 8640 SQFT 803 SQMT
VOLUME 216000 CUFT 6117 CUMT

COOLING LOAD HEATING LOAD
=====

TIME AUG 4 4PM
DRY-BULB TEMP 93F 34C
WET-BULB TEMP 70F 21C

SENSIBLE (KBTU/H) (KW) LATENT (KBTU/H) (KW)

WALLS 32.204 9.432 0.000 0.000
ROOFS 57.900 16.957 0.000 0.000
GLASS CONDUCTION 2.350 0.688 0.000 0.000
GLASS SOLAR 9.120 2.671 0.000 0.000
DOOR 29.695 8.697 0.000 0.000
INTERNAL SURFACES 0.000 0.000 0.000 0.000
UNDERGROUND SURFACES -0.109 -0.032 0.000 0.000
OCCUPANTS TO SPACE 9.121 2.671 17.500 5.125
LIGHT TO SPACE 38.796 11.362 0.000 0.000
EQUIPMENT TO SPACE 0.000 0.000 0.000 0.000
PROCESS TO SPACE 0.000 0.000 0.000 0.000
INFILTRATION 0.000 0.000 0.000 0.000

TOTAL 179.077 52.447 17.500 5.125
TOTAL LOAD 196.577 KBTU/H 57.572 KW
TOTAL LOAD / AREA 22.75BTU/H.SQFT 71.725 W /SQMT

SENSIBLE (KBTU/H) (KW)

-44.491 -13.030
-41.168 -12.057
-10.154 -2.974
0.610 0.179
-39.883 -11.681
0.000 0.000
-3.677 -1.077
0.808 0.237
5.778 1.692
0.000 0.000
0.000 0.000
-126.082 -36.926

-258.259 KBTU/H -75.638 KW
29.891BTU/H.SQFT 94.231 W /SQMT

* * NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* * * * *
* * * * *
* * 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* * IN CONSIDERATION *
* * * * *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR UNIT-HEATS TOPEKA, KS

MONTH	-- COOLING --				-- HEATING --				-- ELEC --			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)		
JAN	0.00000			0.000	-79.641	16	6	10.F 8.F	2941.	14.688		
FEB	0.00000			0.000	-59.710	3	6	-1.F -2.F	2643.	14.592		
MAR	0.00000			0.000	-47.152	3	4	16.F 13.F	3169.	14.599		
APR	0.00000			0.000	-14.941	4	6	32.F 31.F	2860.	14.436		
MAY	0.00000			0.000	-1.975	5	5	44.F 40.F	2845.	14.289		
JUN	0.00000			0.000	0.000			0.000	2978.	14.250		
JUL	0.00000			0.000	0.000			0.000	2708.	14.250		
AUG	0.00000			0.000	0.000			0.000	3114.	14.250		
SEP	0.00000			0.000	0.000			0.000	2843.	14.250		
OCT	0.00000			0.000	-11.400	31	6	44.F 39.F	2720.	14.396		
NOV	0.00000			0.000	-36.401	2	6	15.F 14.F	2750.	14.474		
DEC	0.00000			0.000	-71.124	15	5	8.F 7.F	2929.	14.648		
TOTAL	0.000			0.000	-322.343				34499.			
MAX								-373.671		14.688		

D8-23

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR UNIT-HEATS TOPEKA, KS

MONTH	-- NUMBER OF HOURS --										-- COINCIDENT LOADS --			
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING LOAD	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE	HOURS FANS ON VENTING	HOURS NIGHT WHEN	HOURS FLOATING FANS ON	HEATING LOAD AT PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		
JAN	0	372	0	372	744	0	372	372	0	0	-181.318	0.214		
FEB	0	336	0	336	672	0	336	336	0	0	-177.371	0.210		
MAR	0	350	0	394	744	0	351	351	0	1	0.000	0.000		
APR	0	181	0	539	720	0	279	279	0	98	0.000	0.000		
MAY	0	38	0	706	360	0	179	179	0	141	0.000	0.000		
JUN	0	0	0	720	0	0	0	0	0	0	0.000	0.000		
JUL	0	0	0	744	0	0	0	0	0	0	0.000	0.000		
AUG	0	0	0	744	0	0	0	0	0	0	0.000	0.000		
SEP	0	0	0	720	0	0	0	0	0	0	0.000	0.000		
OCT	0	166	0	578	720	0	259	259	0	93	-126.969	0.145		
NOV	0	307	0	413	720	0	313	313	0	6	0.000	0.000		
DEC	0	372	0	372	744	0	372	372	0	0	0.000	0.000		
ANNUAL	0	2122	0	6638	5424	0	2461	2461	0	339				

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY TOTAL (MBTU) PEAK (KBTU) DY/HR	NATURAL-GAS TOTAL (MBTU) PEAK (KBTU) DY/HR
JAN	14.370 61.851 14/10	14.370 61.851 14/10	115.695 497.806 16/ 6
FEB	12.928 61.521 3/ 8	12.928 61.521 3/ 8	89.889 424.235 3/ 6
MAR	14.653 61.545 3/ 8	14.653 61.545 3/ 8	73.667 414.604 3/ 4
APR	11.517 60.991 4/ 8	11.517 60.991 4/ 8	25.084 278.996 4/ 6
MAY	10.021 55.416 5/ 9	10.021 55.416 5/ 9	3.472 167.408 5/ 5
JUN	10.169 48.656 30/16	10.169 48.656 30/16	0.000 0.000 30/ 1
JUL	9.245 48.656 29/16	9.245 48.656 29/16	0.000 0.000 31/ 1
AUG	10.631 48.656 31/16	10.631 48.656 31/16	0.000 0.000 31/ 1
SEP	9.707 48.656 30/16	9.707 48.656 30/16	0.000 0.000 30/ 1
OCT	10.774 60.852 31/ 8	10.774 60.852 31/ 8	19.450 248.176 31/ 6
NOV	12.689 61.119 3/ 8	12.689 61.119 3/ 8	58.187 332.409 2/ 6
DEC	14.315 61.715 14/ 9	14.315 61.715 14/ 9	105.442 459.530 15/ 5
ONE YEAR USE/PEAK	141.019 61.851	141.019 61.851	490.886 497.806

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE			
IN SITE MBTU -		ELECTRICITY	NATURAL-GAS
CATEGORY OF USE			
SPACE HEAT	15.87		490.89
SPACE COOL	0.00		0.00
HVAC AUX	8.66		0.00
DOM HOT WTR	0.00		0.00
AUX SOLAR	0.00		0.00
LIGHTS	116.48		0.00
VERT TRANS	0.00		0.00
MISC EQUIP	0.00		0.00
TOTAL	141.02		490.89

TOTAL SITE ENERGY 631.91 MBTU 60.3 KBTU/SQFT-YR GROSS-AREA 73.1 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 914.37 MBTU 87.3 KBTU/SQFT-YR GROSS-AREA 105.8 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 9.5
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 9: 8:17 SDL RUN 1											
DENVER, CO 80227 PROPOSED SYSTEMS FOR BLDG. #820 VEHICAL MAINT BAY											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SIM-IR-HET TOPEKA, KS											
----- C O O L I N G ----- H E A T I N G ----- E L E C -----											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-81.477	4	3	8.F 7.F	-236.845	2843.	14.250
FEB	0.00000				-59.727	1	23	17.F 15.F	-193.550	2572.	14.250
MAR	0.00000				-44.909	3	4	16.F 13.F	-187.838	3114.	14.250
APR	0.00000				-11.118	4	6	32.F 31.F	-113.222	2843.	14.250
MAY	0.00000				-0.690	9	6	44.F 44.F	-48.750	2843.	14.250
JUN	0.00000				0.000				0.000	2978.	14.250
JUL	0.00000				0.000				0.000	2708.	14.250
AUG	0.00000				0.000				0.000	3114.	14.250
SEP	0.00000				0.000				0.000	2843.	14.250
OCT	0.00000				-7.466	20	6	24.F 23.F	-97.690	2708.	14.250
NOV	0.00000				-34.121	2	6	15.F 14.F	-141.010	2708.	14.250
DEC	0.00000				-72.463	11	24	10.F 9.F	-204.299	2843.	14.250
TOTAL	0.000				-311.972					34115.	
MAX									-236.845		14.250

D8-26

EMC ENGINEERS INC.		EZDOE - ELITE SOFTWARE DEVELOPMENT INC		DOE-2.1D 2/ 7/1995		9: 8:17 SDL RUN 1	
DENVER, CO 80227		PROPOSED SYSTEMS FOR BLDG. #820		VEHICAL MAINT BAY			
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR		SIM-IR-HET		TOPEKA, KS			
-----		N U M B E R O F H O U R S -----		--COINCIDENT LOADS--			
HOURS		HOURS		HOURS			
COINCIDENT		COINCIDENT		COINCIDENT			
COOL-HEAT		COOL-HEAT		COOL-HEAT			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			
HEATING		HEATING		HEATING			
LOAD		LOAD		LOAD			
COOLING		COOLING		COOLING			
LOAD		LOAD		LOAD			
HOURS		HOURS		HOURS			

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY 13.047 57.383 14/ 9	NATURAL-GAS 96.850 262.898 4/ 3
JAN			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	11.231 54.805 3/ 8	72.473 220.166 1/23
FEB			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	12.473 55.304 3/ 8	55.366 214.380 3/ 4
MAR			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.163 52.117 4/ 8	14.432 135.631 4/ 6
APR			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.735 48.656 31/16	0.999 62.846 9/ 6
MAY			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.169 48.656 30/16	0.000 0.000 30/ 1
JUN			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.245 48.656 29/16	0.000 0.000 31/ 1
JUL			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.631 48.656 31/16	0.000 0.000 31/ 1
AUG			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.707 48.656 30/16	0.000 0.000 30/ 1
SEP			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	51.752 10.644 52.789	9.943 42.615 165.646
OCT			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.644 52.789 30/ 8	2/ 6
NOV			
	TOTAL(MBTU) PEAK(KBTU) DY/HR	12.678 56.274 14/ 8	87.102 230.960 11/24
DEC			
	ONE YEAR USE/PEAK	129.273 57.383	379.779 262.898

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	0.00	379.78
SPACE COOL	0.00	0.00
HVAC AUX	12.79	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	116.48	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	129.27	379.78
TOTAL SITE ENERGY	509.05 MBTU	48.6 KBTU/SQFT-YR GROSS-AREA
TOTAL SOURCE ENERGY	767.99 MBTU	73.3 KBTU/SQFT-YR GROSS-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =	0.0	0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED	0.0	0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.		

BUILDING 7176 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	184.55	131.11	53.44	28.44
Annual Natural Gas (MBTU)	1010.13	853.47	156.66	83.37
Electric Demand June (KW)	14.26	14.26	0.00	0.00
Electric Demand July (KW)	14.26	14.26	0.00	0.00
Electric Demand August (KW)	14.26	14.26	0.00	0.00

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8300 (sq.ft.)	8640
ECO Model Bldg 7176 (sq.ft.)	4598
Square Footage Adjustment Factor	0.532

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005	
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995	
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohler

1. INVESTMENT: BLDG 7176 - Replace Unit Heaters w/ IR Radiant Tube Heat

A. CONSTRUCTION COST	=	\$24,216
B. SIOH COST	(5.5% of 1A) =	\$1,332
C. DESIGN COST	(6.0% of 1A) =	\$1,453
D. TOTAL COST	(1A + 1B + 1C) =	\$27,000
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$27,000

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:					<u>JAN '95</u>	
ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELECT.	\$12.10	28	\$344	15.88	\$5,465	
B. DIST	\$0.00	0	\$0	19.16	\$0	
C. NAT GAS	\$4.12	83	\$343	18.30	\$6,286	
D. COAL	\$0.00	0	\$0	16.62	\$0	
E. ELEC. DEMAND			\$0	14.88	\$0	
F. TOTAL		112	\$688		-----> \$11,750	

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)					
1 ANNUAL MAINTENANCE		\$600	14.88	\$8,921	
2		\$0	14.88	\$0	
3		\$0	14.88	\$0	
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST		\$600		\$8,921	
B. NON-RECURRING (+/-)					
ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)	
			(TABLE A-2)		
a. BASELINE EQUIP. REPLACEMEN	\$24,734	5	0.863	\$21,346	
b.				\$0	
c.				\$0	
d.				\$0	
e.				\$0	
f. TOTAL	\$24,734			\$21,346	
C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)			(3A4 + 3Bf4) =		\$30,267

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$2,524
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	10.70
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$42,017
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	1.56
(MUST HAVE SIR > 1.25 TO QUALIFY)		

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET 1 OF 1		DATE PREPARED 4-May-95		ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7176							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5	STLPIP2	STEEL PIPE SCH. 40, 2" WHANGERS	L.F.	180.0	\$3.91	\$705	Q-1	0.25	\$873
6		VALVES AND FITTINGS ADD 15%				\$106			\$131
7	IRHEAT	GAS FIRED IR TUBE SYSTEMS / BURNER	EA.	5.0	\$1,564.94	\$7,825	Q-6	18.24	\$1,834
8	IRHT30	GAS FIRED IR HEATER, 30 MBH	EA.	2.0	\$324.62	\$649	Q-5	2.667	\$103
9	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	120.0	\$0.83	\$100	1-ELEC	0.064	\$161
10	WIRE#6	COPPER WIRING #6	C.L.F.	1.0	\$24.71	\$25	1-ELEC	1.231	\$26
11	GASCN	FLEXIBLE CONNECTOR 12" LONG	EA.	7.0	\$7.90	\$55	1-PLUM	0.222	\$33
12									
13		EXISTING SYSTEMS DEMOLITION							
14		BOILER DEMOLITION	EA.	1.0			Q-6	12	\$241
15		UNIT HEATER DEMOLITION	TON	1.1			Q-5	14.545	\$310
16		STEAM PIPING DEMOLITION	L.F.	200.0			1-PLUM	0.04	\$172
17		ASBESTOS REMOVAL	GLV. BAG	10.0	\$170.00	\$1,700			\$1,700
18		ASBESTOS REMOVAL ON PIPE	L.F.	200.0	\$3.29	\$658			\$658
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$11,822			\$3,884
32	OH	OVERHEAD			17%	\$1,986			\$653
33	PRO	PROFIT			10%	\$1,381			\$454
34	CONT	CONTINGENCY			20%	\$3,038			\$998
35	TOTAL COST					\$18,227			\$5,989
									\$15,707
									\$2,639
									\$1,835
									\$4,036
									\$24,216

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7176							
2		NON-RECURRING							
3									
4									
5	STMBLR1	BASELINE - EXISTING EQUIP. REPLACEMENT							
6	STLPIP1.5	1,000 MBH STEAM BOILER (Cast Iron)	EA.	1.0	\$6,686.10	\$6,686	Q-7	80	\$1,644
7	STLPIP4	STEEL PIPE SCH. 40, 1.5" WHANGERS	L.F.	190.0	\$2.95	\$560	Q-1	0.2	\$737
8	FTR1.25S	STEEL PIPE SCH. 40, 4" WHANGERS	L.F.	10.0	\$9.16	\$92	Q-15	0.432	\$84
9	UH9	FINNED TUBE RAD. - 1.25" STEEL TUBE, STEEL F	L.F.	20.0	\$28.59	\$572	Q-1	0.444	\$172
10		HORIZ. UNIT HEATER, PROPELLER, 133.3 MBH	EA.	5.0	\$901.17	\$4,506	Q-5	3.2	\$310
11									
12									
13		EXISTING SYSTEMS DEMOLITION							
14		BOILER DEMOLITION	EA.	1.0			Q-6	12	\$241
15		UNIT HEATER DEMOLITION	TON	1.1			Q-5	14.545	\$310
16		STEAM PIPING DEMOLITION	L.F.	200.0			PLUM	0.04	\$129
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$12,415			\$3,628
32	OH	OVERHEAD			17%	\$2,086			\$609
33	PRO	PROFIT			10%	\$1,450			\$424
34	CONT	CONTINGENCY			20%	\$3,190			\$932
35	TOTAL COST					\$19,141			\$5,593
									\$16,043
									\$2,695
									\$1,874
									\$4,122
									\$24,734

ENGINEER'S OPINION OF PROBABLE COST

PROJECT Fort Riley Feasibility Study for HVAC Upgrade
ENGINEER E M C Engineers, Inc.
Denver, CO

SHEET 1 OF 1
DATE PREPARED 4-May-95
ESTIMATOR C. Wohler
CHECKED BY A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7176							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	\$96.90	\$97	Q-6	25	\$503
5	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.	5.0			Q-6	4	\$402
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE				\$97			\$905
16									
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
18	MNT-IR	MAINT. ON IR HEATERS - INSPEC. / YR	EA.	5.0			Q-6	4	\$402
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE				\$0			\$402
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS				\$97			\$503
									\$600



EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 4 RECTANGULAR 4 OTHER 0
 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	GLASS+OPAQUE AREA (SQFT)	AZIMUTH
BAY-AREA		0.000	0.00	0.133	3600.00	0.133	3600.00	0.133	3600.00	NORTH-EAST
BAY-AREA		0.490	56.00	0.133	3544.00	0.139	3600.00	0.139	3600.00	SOUTH-WEST
BAY-AREA		0.490	266.00	0.133	1234.00	0.196	1500.00	0.196	1500.00	NORTH-WEST
BAY-AREA		0.000	0.00	0.092	7440.00	0.092	7440.00	0.092	7440.00	ROOF
BAY-AREA		0.000	0.00	0.020	7440.00	0.020	7440.00	0.020	7440.00	UNDERGRND

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

D
 0
 35

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	0.000	0.133	0.133	0.00	3600.00	3600.00
SOUTH-WEST	0.490	0.133	0.139	56.00	3544.00	3600.00
NORTH-WEST	0.490	0.133	0.196	266.00	1234.00	1500.00
ROOF	0.000	0.092	0.092	0.00	7440.00	7440.00
ALL WALLS	0.490	0.133	0.146	322.00	8378.00	8700.00
WALLS+ROOFS	0.490	0.114	0.121	322.00	15818.00	16140.00
UNDERGRND	0.000	0.020	0.020	0.00	7440.00	7440.00
BUILDING	0.490	0.084	0.089	322.00	23258.00	23580.00

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 IDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 8640 SQFT 803 SQMT
VOLUME 216000 CUFT 6117 CUMT

COOLING LOAD HEATING LOAD
=====

TIME	SEP 6 4PM	DEC 8 1PM
DRY-BULB TEMP	93F 34C	20F -7C
WET-BULB TEMP	76F 24C	17F -8C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	20.461	5.993	0.000	0.000	-33.326	-9.760
ROOFS	21.857	6.401	0.000	0.000	-30.484	-8.928
GLASS CONDUCTION	3.833	1.122	0.000	0.000	-7.984	-2.338
GLASS SOLAR	8.789	2.574	0.000	0.000	3.614	1.058
DOOR	19.780	5.793	0.000	0.000	-28.776	-8.428
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.055	-0.016	0.000	0.000	-2.656	-0.778
OCCUPANTS TO SPACE	8.857	2.594	17.500	5.125	8.670	2.539
LIGHT TO SPACE	36.907	10.809	0.000	0.000	35.571	10.418
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	507.805	148.723	647.265	189.568	-1265.722	-370.698
TOTAL	628.234	183.994	664.765	194.693	-1321.092	-386.915
TOTAL LOAD	1292.998 KBTU/H	378.687 KW	-1321.092 KBTU/H	-386.915 KW		
TOTAL LOAD / AREA	149.65BTU/H.SQFT	471.777 W /SQMT	152.904BTU/H.SQFT	482.028 W /SQMT		

*
* NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR
*
* ---- LOADS
* 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION
*
* IN CONSIDERATION
*

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR UNIT-HEATS TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				-152.395	4 10	8.F	7.F	-1153.493	2975.	15.141	
FEB	0.00000				-108.869	14 10	30.F	27.F	-972.041	2666.	15.141	
MAR	0.00000				-94.123	3 9	17.F	13.F	-1117.751	3194.	15.141	
APR	0.00000				-34.033	4 10	34.F	31.F	-860.876	2871.	15.030	
MAY	0.00000				-5.651	4 17	55.F	53.F	-397.961	2847.	14.560	
JUN	0.00000				0.000				0.000	2978.	14.250	
JUL	0.00000				0.000				0.000	2708.	14.250	
AUG	0.00000				0.000				0.000	3114.	14.250	
SEP	0.00000				0.000				0.000	2843.	14.250	
OCT	0.00000				-24.799	19 11	39.F	32.F	-750.751	2728.	14.920	
NOV	0.00000				-64.337	1 15	36.F	28.F	-889.781	2762.	15.062	
DEC	0.00000				-140.368	8 13	20.F	17.F	-1187.388	2964.	15.141	
TOTAL	0.000				-624.576				-1187.388	34649.	15.141	
MAX												

D8-32

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR UNIT-HEATS TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING LOAD	HEATING LOAD	COOL-HEAT LOAD	COINCIDENT HOURS	COOLING AVAIL.	HEATING AVAIL.	COOLING AVAIL.	HEATING AVAIL.	COOLING PEAK (KBTU/HR)	HEATING PEAK (KBTU/HR)	COOLING PEAK (KW)	HEATING PEAK (KW)
JAN	0	384	0	360	744	0	384	384	0	-204.980	0.169	0.169
FEB	0	336	0	336	672	0	336	336	0	-203.837	0.169	0.169
MAR	0	370	0	374	744	0	370	370	0	-254.702	0.215	0.215
APR	0	231	0	489	720	0	278	278	0	-40.040	0.031	0.031
MAY	0	62	0	682	360	0	194	194	0	0.000	0.000	0.000
JUN	0	0	0	720	0	0	0	0	0	0.000	0.000	0.000
JUL	0	0	0	744	0	0	0	0	0	0.000	0.000	0.000
AUG	0	0	0	744	0	0	0	0	0	0.000	0.000	0.000
SEP	0	0	0	720	0	0	0	0	0	0.000	0.000	0.000
OCT	0	212	0	532	720	0	272	272	0	0.000	0.000	0.000
NOV	0	330	0	390	720	0	333	333	0	0.000	0.000	0.000
DEC	0	382	0	362	744	0	382	382	0	0.000	0.000	0.000
ANNUAL	0	2307	0	6453	5424	0	2549	2549	0	242		

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY 23.163 88.871 27/16	NATURAL-GAS 238.950 1543.960 4/10
JAN	TOTAL(MBTU) PEAK(KBTU) DY/HR	20.113 88.871 14/10	177.244 1337.701 14/10
FEB	TOTAL(MBTU) PEAK(KBTU) DY/HR	21.488 88.871 3/ 9	154.397 1503.793 57.420
MAR	TOTAL(MBTU) PEAK(KBTU) DY/HR	14.927 88.871 4/10	1208.451 9.920 646.644
APR	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.891 86.888 4/11	0.000 0.000 30/ 1
MAY	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.169 48.656 30/16	0.000 0.000 0.000
JUN	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.245 48.656 29/16	0.000 31/ 1 0.000
JUL	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.631 48.656 31/16	0.000 0.000 0.000
AUG	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.707 48.656 30/16	0.000 42.222 1078.248
SEP	TOTAL(MBTU) PEAK(KBTU) DY/HR	13.577 88.116 19/11	107.824 1242.270 1/15
OCT	TOTAL(MBTU) PEAK(KBTU) DY/HR	17.870 88.604 1/15	222.157 1581.841 8/13
NOV	TOTAL(MBTU) PEAK(KBTU) DY/HR	22.764 88.871 30/14	
DEC	TOTAL(MBTU) PEAK(KBTU) DY/HR		
	ONE YEAR USE/PEAK	184.545 88.871	1010.134 1581.841

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE			
IN SITE MBTU -		ELECTRICITY	NATURAL-GAS
CATEGORY OF USE			
SPACE HEAT	40.84	1010.13	
SPACE COOL	0.00	0.00	
HVAC AUX	27.22	0.00	
DOM HOT WTR	0.00	0.00	
AUX SOLAR	0.00	0.00	
LIGHTS	116.48	0.00	
VERT TRANS	0.00	0.00	
MISC EQUIP	0.00	0.00	
TOTAL	184.55	1010.13	
TOTAL SITE ENERGY	1194.68 MBTU	114.1 KBTU/SQFT-YR GROSS-AREA	138.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY	1564.32 MBTU	149.3 KBTU/SQFT-YR GROSS-AREA	181.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 8.3			
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0			
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 SDL RUN 1
 DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR GAS_IR TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)		
JAN	0.00000			0.000	-161.324	14 9	-3.F -4.F	-1209.730	2843.	14.250		
FEB	0.00000			0.000	-114.568	14 10	30.F 27.F	-775.229	2572.	14.250		
MAR	0.00000			0.000	-95.488	3 8	15.F 12.F	-989.212	3114.	14.250		
APR	0.00000			0.000	-29.269	4 10	34.F 31.F	-672.389	2843.	14.250		
MAY	0.00000			0.000	-3.843	5 8	46.F 41.F	-233.841	2843.	14.250		
JUN	0.00000			0.000	0.000			0.000	2978.	14.250		
JUL	0.00000			0.000	0.000			0.000	2708.	14.250		
AUG	0.00000			0.000	0.000			0.000	3114.	14.250		
SEP	0.00000			0.000	0.000			0.000	2843.	14.250		
OCT	0.00000			0.000	-21.190	19 10	38.F 34.F	-582.407	2708.	14.250		
NOV	0.00000			0.000	-64.499	30 8	28.F 25.F	-638.875	2708.	14.250		
DEC	0.00000			0.000	-146.027	8 13	20.F 17.F	-1193.378	2843.	14.250		
TOTAL	0.000			0.000	-636.209			-1209.730	34115.	14.250		
MAX												

D8-40

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 SDL RUN 1
 DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR GAS_IR TOPEKA, KS

MONTH	COOLING				HEATING				ELEC			
	COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON VENTING	HOURS FLOTTING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		
JAN	0	744	0	0	744	744	0	0	-97.173	0.000		
FEB	0	671	0	1	672	672	0	0	-96.123	0.000		
MAR	0	710	0	34	744	744	0	0	-96.846	0.000		
APR	0	325	0	395	720	720	0	0	0.000	0.000		
MAY	0	76	0	668	360	744	0	0	0.000	0.000		
JUN	0	0	0	720	0	720	0	0	0.000	0.000		
JUL	0	0	0	744	0	744	0	0	0.000	0.000		
AUG	0	0	0	744	0	744	0	0	0.000	0.000		
SEP	0	0	0	720	0	720	0	0	0.000	0.000		
OCT	0	290	0	454	744	744	0	0	-68.154	0.000		
NOV	0	580	0	140	720	720	0	0	-107.993	0.000		
DEC	0	743	0	1	744	744	0	0	-107.135	0.000		
ANNUAL	0	4139	0	4621	8760	5424	0	0				

EMC ENGINEERS INC. 80227 EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 PDL RUN 1
 DENVER, CO PROPOSED UP-GRADE FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY- TOTAL(MBTU) PEAK(KBTU) DY/HR	ELECTRICITY 13.417 76.480 14/ 9	NATURAL-GAS 207.320 1342.800 14/ 9
JAN	TOTAL(MBTU) PEAK(KBTU) DY/HR	13.417 76.480 14/ 9	207.320 1342.800 14/ 9
FEB	TOTAL(MBTU) PEAK(KBTU) DY/HR	11.417 66.486 14/10	152.426 904.349 14/10
MAR	TOTAL(MBTU) PEAK(KBTU) DY/HR	12.827 71.408 3/ 8	130.745 1125.162 3/ 8
APR	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.380 64.121 4/10	42.944 794.853 4/10
MAY	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.795 54.034 5/ 8	6.521 303.345 5/ 8
JUN	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.169 48.656 30/16	0.000 0.000 30/ 1
JUL	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.245 48.656 29/16	0.000 0.000 31/ 1
AUG	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.631 48.656 31/16	0.000 0.000 31/ 1
SEP	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.707 48.656 30/16	0.000 0.000 30/ 1
OCT	TOTAL(MBTU) PEAK(KBTU) DY/HR	9.732 62.051 19/10	32.516 697.252 19/10
NOV	TOTAL(MBTU) PEAK(KBTU) DY/HR	10.728 63.350 30/ 8	91.211 758.697 30/ 8
DEC	TOTAL(MBTU) PEAK(KBTU) DY/HR	13.065 76.103 8/13	189.783 1327.008 8/13
ONE YEAR USE/PEAK	131.115 76.480	853.466 1342.800	

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 PDL RUN 1
 DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #7176 VEHICAL MAINT BAY
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	0.00	853.47
SPACE COOL	0.00	0.00
HVAC AUX	14.63	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	116.48	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	131.11	853.47

TOTAL SITE ENERGY 984.58 MBTU 94.0 KBTU/SQFT-YR GROSS-AREA 114.0 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 1247.20 MBTU 119.1 KBTU/SQFT-YR GROSS-AREA 144.4 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

Slash fuel bills up to 50% and more by reducing fuel consumption

CO-RAY-VAC uses less fuel than other heating systems. Because less fuel is used, heating bills are lower. These fuel savings are due to the sum of four major factors:

■ High Combustion Efficiency

The patented CO-RAY-VAC system is the only gas-fired, vacuum vented, tube type radiant heating system manufactured in the U.S.A. that has burners firing in series to produce more uniform heat. With exhaust temperatures of 150° to 200° F, it achieves a combustion efficiency in the range of 90%. Unit heaters and central heating systems with exhaust temperatures of 500°-600° F have combustion efficiencies of 60-75%. CO-RAY-VAC's high combustion efficiency turns almost every BTU generated into usable heat.

■ Less Heat Stratification

CO-RAY-VAC beams its heat downward to people, floors and objects. The floors and objects become reservoirs of heat so when open doors are closed, comfort conditions are quickly regained. With warm air systems, air is heated and rises causing cold conditions at floor level and stratification of warm air at the roof. CO-RAY-VAC drastically reduces heat stratification.

■ Comfort at Lower Temperatures

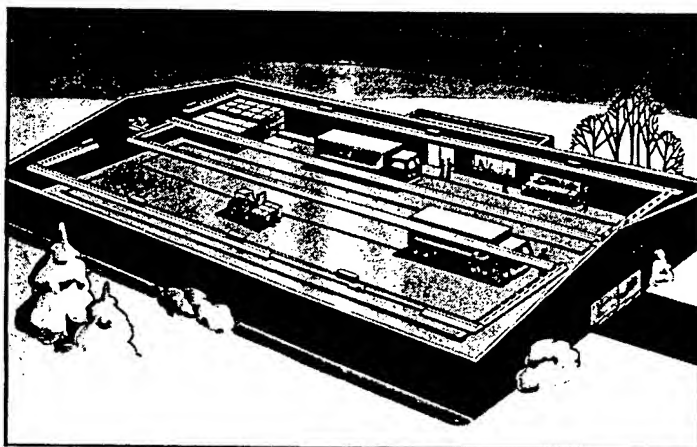
CO-RAY-VAC users report that inside air temperatures have been kept 5-10° lower while maintaining the same comfort level.

■ Reduced Building Heat Loss

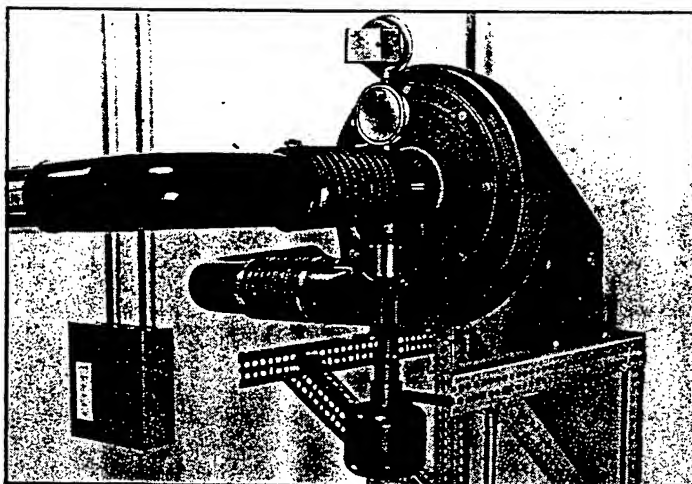
CO-RAY-VAC's vacuum pump closes the system when it is not firing, so there is no heat lost out the exhaust tubes. Standard direct spark ignition means there are no standing pilots to waste fuel.

How a Typical CO-RAY-VAC Heating Installation Works

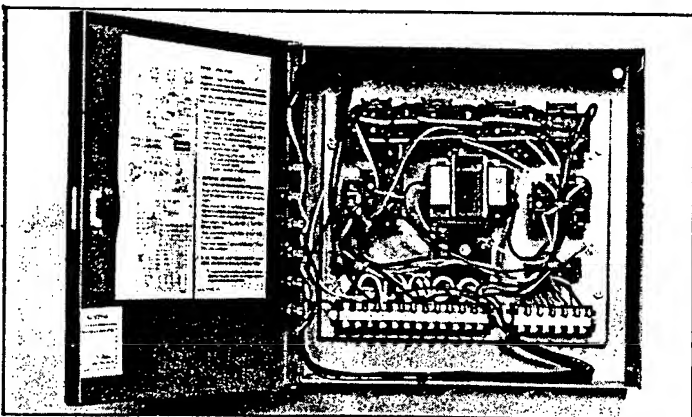
The system consists of a number of burners connected by tubes which radiate heat. The entire system is suspended from the ceiling. Metal reflectors over the tubes direct heat downward, warming people and objects below. There is no blowing of air to create warm and cold spots or to stir up dust and dirt. At the end of the system a powerful exhauster expels the by-products of combustion outdoors.



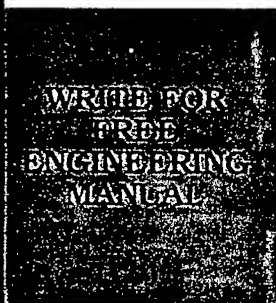
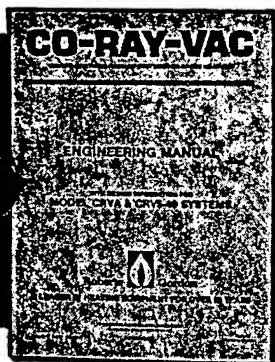
CO-RAY-VAC Annual Fuel Utilization Efficiency (AFUE) has been verified at 90.43% by Gas Consultants Inc. and independent testing laboratory.



Exhauster: A heavy, cast-iron vacuum pump located at the end of the system draws the heat through the system, and completely exhausts all the products of combustion to the outdoors at temperatures usually below 200° F.



Pre-Wired Control Panel: CO-RAY-VAC heating systems are controlled by a pre-wired control panel. These panels are assembled and tested at the factory to reduce installation labor. The panel contains 4 zone relays which allow the system to be divided into separate heating areas each with its own thermostat.



CO-RAY-VAC Specifications

Natural or LP Gas

Factory Furnished Components

All components are heavy-duty type to insure long life and minimum maintenance.

Equipment supplied by Roberts-Gordon consists of the following components:

- Durable steel or cast iron combustion chambers
- Burner controls and cast iron burner
- Pipe and Reflector Hangers
- Aluminum reflectors
- Vacuum pumps
- Pre-wired control panel
- Thermostats
- Radiant Pipe (between burners): 4" 16 gauge steel for CRV-B series (supplied); 4" schedule 40 steel optional (not supplied)
- Balance of Pipe: 4" 16 gauge steel with porcelain interior for all models
- OPTIONAL: • perimeter-type reflectors for use in crane areas, etc.
- Decorative grilles with specially designed reflectors

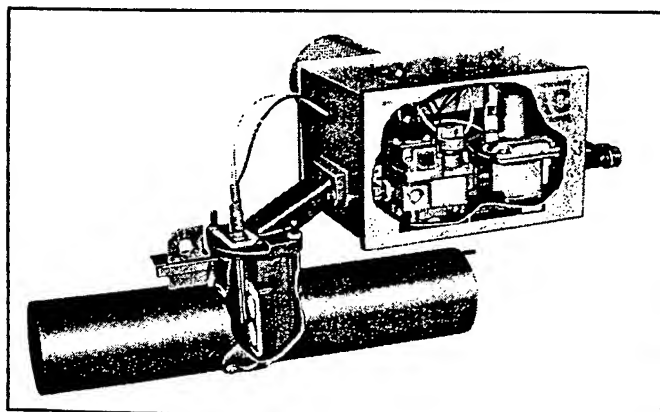
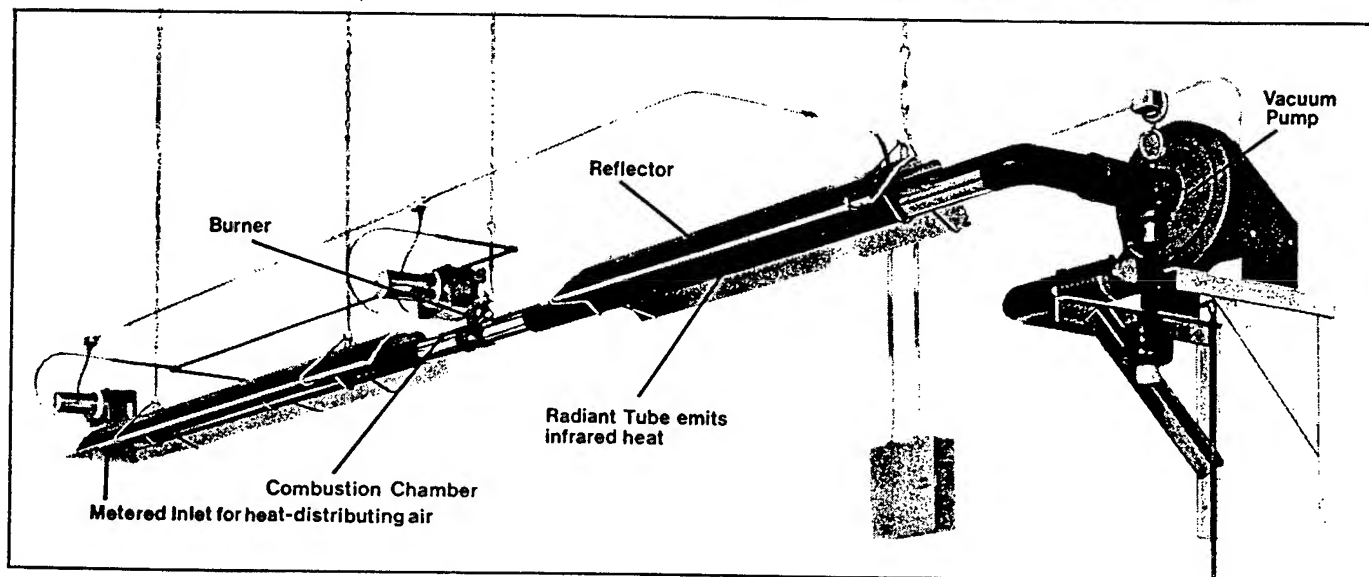
Engineering Data

Pressure: Natural Gas: 4.5 W.C.; L.P. Gas: 11" W.C. Burner: 115V AC, 60 Hz current required for each burner: amperage .30. Vacuum Pump Motor: 115V AC, 60 Hz, 3450 RPM ¼ HP TEFC capacitor single phase ball-bearing thermally-protected.

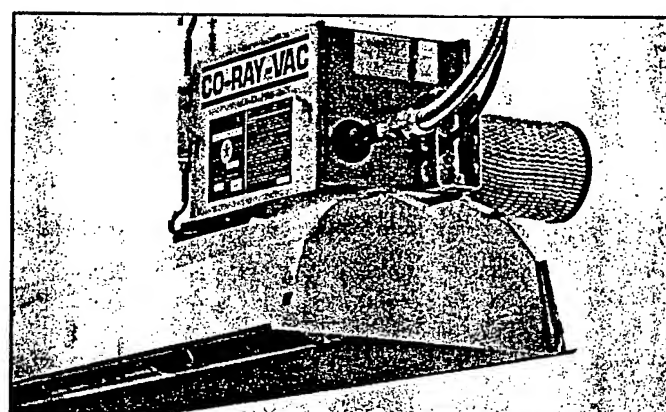
MODELS CRV-B (2, 4, 6, 8)				MODELS CRV-B (10, 12)		
REFLECTOR TYPE	SIDE	TOP	BELOW	SIDE	TOP	BELOW
STANDARD REFLECTOR	26"	4"	48"	26"	4"	60"
W/ ONE SIDE EXTENSION	26"	4"	56"	22"	4"	50"
W/ TWO SIDE EXTENSION		4"	56"		4"	60"
1 FT. WIDE W/GRILLE	12"	4"	48"	15"	4"	56"
2 FT. WIDE W/GRILLE	12"	4"	48"	15"	4"	56"
STANDARD SYSTEM Downstream from Burner (Note 1)						
STANDARD REFLECTOR	10"	4"	18"	15"	4"	24"

NOTES: 1. CLEARANCES FROM TUBE AS SHOWN APPLY ONLY DOWNSTREAM FROM BURNERS AS FOLLOWS:
CRV-B2, 4, 6, 8 OVER 20 FEET DOWNSTREAM.
CRV-B10, 12 OVER 30 FEET DOWNSTREAM.

Patents and patents pending in United States, Canada, United Kingdom and free Europe. Specifications shown are subject to change without notice.



Burners: CO-RAY-VAC unique burners constantly regulate the air-to-gas mixture to achieve the very best ratio for clean, efficient combustion. Each burner is in effect a miniature furnace occupying a space about 1 ft. high by 1 ½ ft. long. CO-RAY-VAC is the only AGA certified system that has burners firing one after the other down the same length of tube. This unique design provides higher levels of comfort and heat uniformity.



Radiant Tubes and Reflectors: The burners are located about 20' apart and are connected by radiant tubes. The heat created by the burners is drawn through the tubes, which radiate warmth. Aluminum reflectors reflect heat towards the floor where it is most needed.

Burner Model No.	CRV B-4	CRV B-6	CRV B-8	CRV B-10	CRV B-12 B-11
Input BTU/Hr (1000's)	40	60	80	100	120 110
Flow Units per Burner	4	6	8	10	12 11
Flow Units per End Vent	10	15	20	20	20
Maximum No. Burners per Branch	4	4	3	3	2
Maximum Flow Units per Branch	26	39	44	50	44
Radlant Tube Length Distance Between Burners) <div>Minimum (ft.)</div> <div>Maximum (ft.)</div>	<div>12.5</div> <div>25</div>	<div>20</div> <div>35</div>	<div>25</div> <div>45</div>	<div>30</div> <div>60</div>	<div>35</div> <div>(70)</div>
Tailpipe Length per Flow Unit <div>Minimum (ft.)</div> <div>Maximum (ft.)</div>	<div>1.2</div> <div>3.0</div>	<div>1.2</div> <div>3.0</div>	<div>1.2</div> <div>3.0</div>	<div>1.2</div> <div>3.0</div>	<div>1.2</div> <div>3.0</div>
Minimum Tube Length from Burner <div>Downstream to Elbow (ft.)</div> <div>Upstream to Elbow (ft.)</div>	<div>5</div> <div>2</div>	<div>10</div> <div>2</div>	<div>10</div> <div>2</div>	<div>15</div> <div>2</div>	<div>15</div> <div>2</div>
Suggested Minimum Mounting Height (ft.)	8	8	10	15	15

FIGURE 3: Design Parameters

2/1/95

Phone Contact

CRV-B-110 BTU

Carl Becker
Co Ray Vac

279-4971

110 Burners

can put up to 6 burners/fan

[\$ 2,000 / Burner]
Small quantities
Material only

Large quantities

\$ 3,000 / Burner = material \$ 1,900 / Burner + labor \$ 1,100 / Burner

B-2 = 20 MBH

B-4 = 40 MBH

B-6 = 60 MBH

B-8 = 80 MBH

B-10 = 100 MBH

B-11 = 6 / Vac pump max 110 MBH used to be the
120 MBH model But do not make 120 MBH models
any longer.

BUILDING 202 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	567.15	550.60	16.55	19.53
Annual Natural Gas (MBTU)	618.86	493.62	125.24	147.77
Electric Demand June (KW)	28.31	27.54	0.77	0.91
Electric Demand July (KW)	28.31	27.54	0.77	0.91
Electric Demand August (KW)	28.31	27.54	0.77	0.91

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8069 (sq.ft.)	10101
ECO Model Bldg 202 (sq.ft.)	11918
Square Footage Adjustment Factor	1.180

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005	
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995	
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohler

1. INVESTMENT: BLDG 202 - Replace STM UHs w/ H&V CEILING MOUNTED UNITS

A. CONSTRUCTION COST	=	\$57,400
B. SIOH COST	(5.5% of 1A) =	\$3,157
C. DESIGN COST	(6.0% of 1A) =	\$3,444
D. TOTAL COST	(1A + 1B + 1C) =	\$64,001
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$64,001

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	20	\$236	15.88	\$3,753
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	148	\$609	18.30	\$11,141
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$48	14.88	\$720
F. TOTAL		167	\$894		-----> \$15,614

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	\$17,611	5	0.863	\$15,198
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$17,611			\$15,198

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$15,198

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$1,774
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	36.08
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$30,812
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	0.48

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95			
ENGINEER E M C Engineers, Inc.				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 202							
2		PROPOSED SYSTEM MODIFICATIONS							
3		NEW SYSTEMS INSTALLATION							
4		STEEL PIPE SCH. 40, 2.5" WHANGERS	L.F.	210.0	\$5.28	\$1,109	Q-15	0.34	\$1,384
5	STLPIP2.5	STEEL PIPE SCH. 40, 1" WHANGERS	L.F.	210.0	\$2.10	\$442	Q-1	0.151	\$615
6	STLPIP1	FITTINGS, 5%				\$78			\$100
7		1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	210.0	\$0.62	\$130	Q-14	0.073	\$282
8	INSLPIP1	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	210.0	\$1.60	\$336	Q-14	0.089	\$344
9	INSLPIP2	ELECTRICAL CONDUIT 1"	L.F.	150.0	\$0.83	\$125	1-ELEC	0.064	\$201
10	ELCND1	COPPER WIRING #6	C.L.F.	1.5	\$24.71	\$37	1-ELEC	1.231	\$39
11	WIRE#6	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	5140.0	\$0.45	\$2,291	Q-10	0.087	\$8,688
12	DUCT500	6,750 CFM AHU, HEATING ONLY	EA.	4.0	\$4,129.88	\$16,520	Q-5	52.5	\$4,072
13	AHU6750								
14									
15									
16									
17									
18									
19									
20									
21		EXISTING SYSTEMS DEMOLITION							
22		UNIT HEATER DEMO	EA.	2.0			Q-6	10.9	\$438
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$21,067			\$16,164
32	OH	OVERHEAD			17%	\$3,539			\$2,715
33	PRO	PROFIT			10%	\$2,461			\$1,888
34	CONT	CONTINGENCY			20%	\$5,413			\$4,153
35		TOTAL COST				\$32,480			\$24,920
									\$37,230
									\$6,255
									\$4,349
									\$9,567
									\$57,400

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade			SHEET		1	OF	1	
ENGINEER		E M C Engineers, Inc. Denver, CO			DATE PREPARED		4-May-95			
					ESTIMATOR		C. Wohliert			
					CHECKED BY		A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL	
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit		Total
1		BUILDING 202								
2		NON-RECURRING								
3										
4		BASELINE - EXISTING EQUIP. REPLACEMENT								
5	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	30.0	\$5.28	\$158	Q-15	0.34	\$198	\$356
6	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	30.0	\$2.10	\$63	Q-1	0.151	\$88	\$151
7		FITTINGS, 5%				\$11			\$14	\$25
8	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	30.0	\$0.62	\$19	Q-14	0.073	\$40	\$59
9	INSLPIP2	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	30.0	\$1.60	\$48	Q-14	0.089	\$49	\$97
10	AHU6750	6,750 CFM AHU, HEATING ONLY	EA.	2.0	\$4,129.88	\$8,260	Q-5	52.5	\$2,036	\$10,296
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21		EXISTING SYSTEMS DEMOLITION								
22		UNIT HEATER DEMO	EA.	2.0			Q-6	10.9	\$438	\$438
23										
24										
25										
26										
27										
28										
29										
30										
31		SUBTOTAL				\$8,559			\$2,864	\$11,423
32	OH	OVERHEAD			17%	\$1,438			\$481	\$1,919
33	PRO	PROFIT			10%	\$1,000			\$334	\$1,334
34	CONT	CONTINGENCY			20%	\$2,199			\$736	\$2,935
35	TOTAL COST					\$13,196			\$4,415	\$17,611

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET 1 OF 1		DATE PREPARED 4-Mar-95			
ENGINEER		E M C Engineers, Inc. Denver, CO		ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer			
Line No.	Item Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost		Crew/Worker	Hours/Unit	Total
1		BUILDING 202							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE				\$0			\$0
16									
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE				\$0			\$0
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS				\$0			\$0

DEMAND LIMITING ANALYSIS BUILDING 202

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14843	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	0.91	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91
CAPACITY (KW)	32471	34451	26136	20754	26400	22752	27108	25812	23310	21834	21996	30095
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32733	34764	26373	20775	26453	22820	27244	25916	23404	21878	22084	30461
80% SUMMER PEAK (KVA)	27811	27811	27811	27811	27811	27811	27811	27811	27811	27811	27811	27811
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32733	34764	27811	27811	27811	27811	27811	27811	27811	27811	27811	30461
ACTUAL OR 80% PEAK	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,138.48	\$138,364.08	\$110,205.26	\$110,205.26	\$110,205.26	\$110,205.26	\$110,205.26	\$110,205.26	\$110,205.26	\$110,205.26	\$110,205.26	\$120,935.52
SUB DISCOUNT \$.20	(\$6,546.59)	(\$6,952.79)	(\$5,562.24)	(\$5,562.24)	(\$5,562.24)	(\$5,562.24)	(\$5,562.24)	(\$5,562.24)	(\$5,562.24)	(\$5,562.24)	(\$5,562.24)	(\$6,092.12)
CAPACITY CHARGE	\$126,181.89	\$134,001.29	\$107,233.03	\$107,233.03	\$107,233.03	\$107,233.03	\$107,233.03	\$107,233.03	\$107,233.03	\$107,233.03	\$107,233.03	\$117,433.39
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,222.06	\$68,206.91	\$54,565.53	\$54,565.53	\$54,565.53	\$54,565.53	\$54,565.53	\$54,565.53	\$54,565.53	\$54,565.53	\$54,565.53	\$59,763.74
100*KVA @ \$.03404	\$111,422.99	\$118,336.56	\$94,669.24	\$94,669.24	\$94,669.24	\$94,669.24	\$94,669.24	\$94,669.24	\$94,669.24	\$94,669.24	\$94,669.24	\$103,687.96
250*KVA @ \$.03084	\$252,371.11	\$268,030.21	\$209,968.70	\$184,063.10	\$214,424.17	\$214,424.17	\$214,424.17	\$214,424.17	\$214,424.17	\$212,744.30	\$171,110.30	\$234,851.40
EXCESS @ \$.02864	\$109,600.03	\$65,711.96	\$0.00	\$0.00	\$1,017.56	\$51,710.36	\$42,259.16	\$32,807.96	\$38,822.36	\$0.00	\$0.00	\$28,231.91
ENERGY CHARGE	\$537,616.19	\$520,285.63	\$359,203.47	\$333,297.87	\$364,676.51	\$415,369.31	\$405,918.11	\$396,466.91	\$402,481.31	\$361,979.07	\$320,345.07	\$426,535.01
TOTAL CHARGE LESS ECA	\$663,798.08	\$654,286.92	\$466,436.50	\$440,530.90	\$471,909.53	\$522,602.33	\$513,151.13	\$503,699.93	\$509,714.33	\$469,212.10	\$427,578.10	\$543,968.40
SUMMARY												
MONTHLY DIFFERENCE	\$4.99	\$5.00	\$3.35	\$3.35	\$4.00	\$4.00	\$4.00	\$4.00	\$4.00	\$3.35	\$3.35	\$5.01
ANNUAL DIFFERENCE.....		\$48.41										

EMC ENGINEERS INC. EZZOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:22:41 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 202 THE GYM AREA
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 4 RECTANGULAR 4 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - G L A S S - - -		- - - W A L L - - -		- - -		- W A L L + G L A S S -		AZIMUTH
		U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	
B-BALL-CT		0.000	0.00	0.037	2275.00	0.037	2275.00	0.037	2275.00	EAST
B-BALL-CT		0.000	0.00	0.037	3052.50	0.037	3052.50	0.037	3052.50	SOUTH
B-BALL-CT		0.490	60.00	0.037	2215.00	0.049	2275.00	0.049	2275.00	WEST
B-BALL-CT		0.000	0.00	0.062	10101.00	0.062	10101.00	0.062	10101.00	ROOF
B-BALL-CT		0.000	0.00	0.020	728.00	0.020	728.00	0.020	728.00	UNDERGRND
B-BALL-CT		0.000	0.00	0.020	720.00	0.020	720.00	0.020	720.00	UNDERGRND
B-BALL-CT		0.000	0.00	0.020	752.00	0.020	752.00	0.020	752.00	UNDERGRND
B-BALL-CT		0.000	0.00	0.020	10101.00	0.020	10101.00	0.020	10101.00	UNDERGRND

EMC ENGINEERS INC. EZZOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:22:41 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 202 THE GYM AREA
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

SURFACE	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)		AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)		AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)		GLASS AREA (SQFT)		OPAQUE AREA (SQFT)		GLASS+OPAQUE AREA (SQFT)	
	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)	U-VALUE (BTU/HR-SQFT-F)
EAST	0.000	0.037	0.037	0.037	0.037	0.00	0.00	2275.00	2275.00	2275.00	2275.00	2275.00
SOUTH	0.000	0.037	0.037	0.037	0.037	0.00	0.00	3052.50	3052.50	3052.50	3052.50	3052.50
WEST	0.490	0.037	0.037	0.049	0.049	60.00	60.00	2215.00	2215.00	2215.00	2275.00	2275.00
ROOF	0.000	0.062	0.062	0.062	0.062	0.00	0.00	10101.00	10101.00	10101.00	10101.00	10101.00
ALL WALLS	0.490	0.037	0.037	0.040	0.040	60.00	60.00	7542.50	7542.50	7542.50	7602.50	7602.50
WALLS+ROOFS	0.490	0.051	0.051	0.053	0.053	60.00	60.00	17643.50	17643.50	17643.50	17703.50	17703.50
UNDERGRND	0.000	0.020	0.020	0.020	0.020	0.00	0.00	12301.00	12301.00	12301.00	12301.00	12301.00
BUILDING	0.490	0.038	0.038	0.039	0.039	60.00	60.00	29944.50	29944.50	29944.50	30004.50	30004.50

*** BUILDING ***

FLOOR AREA 10101 SQFT 938 SQMT
VOLUME 333333 CUFT 9440 CUMT

TIME	COOLING LOAD		HEATING LOAD	
	DRY-BULB TEMP	WET-BULB TEMP	JAN 16 8AM	14F -10C
	95F	77F	11F	-12C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	5.223	1.530	0.000	0.000	-19.411	-5.685
ROOFS	21.868	6.405	0.000	0.000	-41.434	-12.135
GLASS CONDUCTION	0.900	0.264	0.000	0.000	-1.986	-0.582
GLASS SOLAR	3.522	1.032	0.000	0.000	0.172	0.050
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.164	-0.341	0.000	0.000	-7.063	-2.069
OCCUPANTS TO SPACE	20.394	5.973	32.768	9.597	1.259	0.369
LIGHT TO SPACE	71.593	20.968	0.000	0.000	7.117	2.084
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	14.607	4.278	21.851	6.400	-35.406	-10.370
TOTAL	136.944	40.107	54.619	15.997	-96.753	-28.336
TOTAL LOAD	191.563 KBTU/H	56.104 KW	59.786 W /SQMT		-96.753 KBTU/H	-28.336 KW
TOTAL LOAD / AREA	18.96BTU/H.SQFT	59.786 W /SQMT			9.579BTU/H.SQFT	30.196 W /SQMT

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				-121.250	15	-8.F	-9.F	-519.665	12721.	28.294	
FEB	0.00000				-77.889	3	-5.F	-6.F	-488.342	11213.	28.294	
MAR	0.00000				-56.840	3	14.F	12.F	-377.592	12569.	28.294	
APR	0.00000				-17.517	5	31.F	29.F	-257.194	12848.	28.294	
MAY	0.00000				-4.446	5	44.F	40.F	-166.788	14067.	28.294	
JUN	0.00000				0.000				0.000	14055.	28.294	
JUL	0.00000				0.000				0.000	14426.	28.294	
AUG	0.00000				0.000				0.000	14770.	28.294	
SEP	0.00000				0.000				0.000	13908.	28.294	
OCT	0.00000				-17.194	20	23.F	22.F	-294.129	13362.	28.294	
NOV	0.00000				-42.088	3	13.F	12.F	-367.513	12273.	28.294	
DEC	0.00000				-89.447	12	4.F	3.F	-441.779	12303.	28.294	
TOTAL MAX	0.000				-426.672				-519.665	158522.	28.294	

D9-9

MONTH	HOURS				HOURS				HOURS				HOURS				--COINCIDENT LOADS--			
	COOLING LOAD	HEATING LOAD	COOL-HEAT LOAD	FLOATING	HEATING AVAIL.	COOLING AVAIL.	FANS ON	FANS ON CYCLE ON	NIGHT VENTING	FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	COOLING LOAD AT COOLING PEAK (KW)	COOLING LOAD AT COOLING PEAK (KW)	COOLING LOAD AT COOLING PEAK (KW)	COOLING LOAD AT COOLING PEAK (KW)				
JAN	0	405	0	339	744	0	405	405	0	0	-231.111	5.753	0.000	0.000	0.000	0.000				
FEB	0	323	0	349	672	0	323	323	0	0	0.000	0.000	0.000	0.000	0.000	0.000				
MAR	0	346	0	398	744	0	355	355	0	9	-235.639	5.753	0.000	0.000	0.000	0.000				
APR	0	342	0	378	720	0	474	474	0	132	0.000	0.000	0.000	0.000	0.000	0.000				
MAY	0	165	0	579	360	0	639	639	0	474	0.000	0.000	0.000	0.000	0.000	0.000				
JUN	0	0	0	720	0	0	680	680	0	680	0.000	0.000	0.000	0.000	0.000	0.000				
JUL	0	0	0	744	0	0	721	721	0	721	0.000	0.000	0.000	0.000	0.000	0.000				
AUG	0	0	0	744	0	0	722	722	0	722	0.000	0.000	0.000	0.000	0.000	0.000				
SEP	0	0	0	720	0	0	674	674	0	674	0.000	0.000	0.000	0.000	0.000	0.000				
OCT	0	356	0	388	720	0	536	536	0	180	-168.544	5.753	0.000	0.000	0.000	0.000				
NOV	0	332	0	388	720	0	378	378	0	46	0.000	0.000	0.000	0.000	0.000	0.000				
DEC	0	348	0	396	744	0	348	348	0	0	-272.716	5.753	0.000	0.000	0.000	0.000				
ANNUAL	0	2617	0	6143	5424	0	6255	6255	0	3638										

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 48.765 109.979 31/21	NATURAL-GAS 166.272 653.981 15/ 4
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	42.478 109.979 28/22	111.178 620.982 3/ 7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	46.664 109.979 31/21	84.210 501.325 3/ 7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	45.905 109.979 24/ 9	29.320 365.966 5/ 5
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.778 109.775 9/ 7	8.196 260.713 5/ 7
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	47.991 96.606 30/22	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	49.258 96.606 31/20	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	50.432 96.606 31/22	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	47.488 96.606 30/22	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	47.807 109.979 31/ 6	29.615 408.076 20/ 8
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	45.100 109.979 30/22	64.216 490.205 3/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	46.499 109.979 31/11	125.854 571.241 12/ 5
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	567.166 109.979	618.861 653.981

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	21.05	618.86
SPACE COOL	0.00	0.00
HVAC AUX	127.75	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	418.35	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	567.15	618.86

TOTAL SITE ENERGY 1186.03 MBTU 54.3 KBTU/SQFT-YR GROSS-AREA 117.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2322.06 MBTU 106.2 KBTU/SQFT-YR GROSS-AREA 229.9 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:24:12 SDL RUN 1											
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 202 THE GYM AREA											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V SYSTEMS TOPEKA, KS											
----- C O O L I N G ----- H E A T I N G ----- E L E C -----											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-95.741	15	-8.F	-9.F	-490.946	12226.	27.526
FEB	0.00000				-60.913	3	-5.F	-6.F	-460.894	10890.	27.526
MAR	0.00000				-45.885	3	14.F	12.F	-347.743	12471.	27.526
APR	0.00000				-12.606	5	31.F	29.F	-219.333	12893.	27.526
MAY	0.00000				-3.540	1	38.F	37.F	-136.802	13737.	27.526
JUN	0.00000				0.000				0.000	13524.	27.526
JUL	0.00000				0.000				0.000	13868.	27.526
AUG	0.00000				0.000				0.000	14221.	27.526
SEP	0.00000				0.000				0.000	13391.	27.526
OCT	0.00000				-13.593	20	23.F	23.F	-263.341	13340.	27.526
NOV	0.00000				-31.408	3	13.F	12.F	-334.676	12157.	27.526
DEC	0.00000				-70.635	15	3.F	2.F	-416.943	11971.	27.526
TOTAL	0.000				-334.321					154686.	
TAX									-490.946		27.526

D9-12

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:24:12 SDL RUN 1												
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 202 THE GYM AREA												
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V SYSTEMS TOPEKA, KS												
----- N U M B E R O F H O U R S -----												
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	368	0	376	744	0	368	368	0	0	0.000	0.000
FEB	0	308	0	364	672	0	308	308	0	0	-207.612	4.986
MAR	0	362	0	382	744	0	390	390	0	28	-206.014	4.986
APR	0	362	0	358	720	0	556	556	0	194	-67.109	4.986
MAY	0	174	0	570	360	0	671	671	0	497	0.000	0.000
JUN	0	0	0	720	0	0	678	678	0	678	0.000	4.986
JUL	0	0	0	744	0	0	720	720	0	720	0.000	4.986
AUG	0	0	0	744	0	0	723	723	0	723	0.000	4.986
SEP	0	0	0	720	0	0	674	674	0	674	0.000	4.986
OCT	0	390	0	354	720	0	614	614	0	224	-137.293	4.986
NOV	0	345	0	375	720	0	413	413	0	68	-240.486	4.986
DEC	0	335	0	409	744	0	335	335	0	0	-239.171	4.986
ANNUAL	0	2644	0	6116	5424	0	6450	6450	0	3806		

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 46.187 106.621 31/22	NATURAL-GAS 132.381 617.840 15/ 6
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	40.813 106.621 28/21	88.615 586.177 3/ 7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	45.909 106.621 31/21	69.242 463.711 3/ 7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	45.775 106.621 15/ 8	22.061 318.504 5/ 5
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	47.571 103.363 9/ 7	6.724 221.684 1/ 5
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	46.176 93.987 30/22	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	47.353 93.987 31/20	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.558 93.987 31/22	0.000 0.000 0.000
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	45.723 93.987 30/22	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	47.506 106.621 31/ 6	24.133 369.014 20/ 7
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	44.249 106.621 30/21	49.359 449.238 3/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	44.779 106.621 31/19	101.105 539.218 15/ 2
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	550.598 106.621	493.620 617.840
	ONE YEAR USE/PEAK		

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:24:12 PDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 202 THE GYM AREA
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	17.77	493.62
SPACE COOL	0.00	0.00
HVAC AUX	114.47	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	418.37	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	550.60	493.62

TOTAL SITE ENERGY 1044.22 MBTU 47.8 KBTU/SQFT-YR GROSS-AREA 103.4 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 2147.07 MBTU 98.2 KBTU/SQFT-YR GROSS-AREA 212.6 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.1
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 7485

ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	2233.59	1745.40	488.19	488.19
Annual Natural Gas (MBTU)	1218.76	1511.28	-292.52	-292.52
Electric Demand June (KW)	138.43	121.10	17.33	17.33
Electric Demand July (KW)	149.33	133.81	15.52	15.52
Electric Demand August (KW)	146.43	130.68	15.75	15.75

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7485 (sq.ft.)	35216
ECO Model Bldg 7485 (sq.ft.)	35216
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE:	05/08/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 7485 - Convert DD AHUs to DDs with VAV Units

A. CONSTRUCTION COST	=	\$13,502
B. SIOH COST	(5.5% of 1A) =	\$743
C. DESIGN COST	(6.0% of 1A) =	\$810
D. TOTAL COST	(1A + 1B + 1C) =	\$15,055
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$15,055

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	488	\$5,907	15.88	\$93,805
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(293)	(\$1,205)	18.30	(\$22,055)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$850	14.88	\$12,642
F. TOTAL		196	\$5,552		-----> \$84,392

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE	\$0		14.88	\$0
2	\$0		14.88	\$0
3	\$0		14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-)	\$0			\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$0			\$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$5,552

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 2.71

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$84,392

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 5.61

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET		1		OF		1	
		DATE PREPARED		8-May-95					
		ESTIMATOR		C. Wohler					
		CHECKED BY		A. Niemeyer					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 7485							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4	VSD20	VARIABLE SPEED DRIVE W/ CONTRLER,20HP	EA.	1	\$4,844.03	\$4,844	1-ELEC	19	\$398
5	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	12	\$24.23	\$291	1-ELEC	0.8	\$201
6	WIRE#12	COPPER WIRING #12	C.L.F.	8	\$7.41	\$62	1-ELEC	0.727	\$128
7	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	19	\$331.40	\$6,297	1-SHEE	1.5	\$593
8									\$5,242
9									\$492
10									\$190
11									\$6,890
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26		DUAL DUCT MIXING BOX DEMO	EA.	19.0			1-SHEE	3	\$1,186
27									\$1,186
28									
29									
30									
31		SUBTOTAL				\$6,650			\$2,108
32	OH	OVERHEAD			17%	\$1,117			\$354
33	PRO	PROFIT			10%	\$777			\$246
34	CONT	CONTINGENCY			20%	\$1,709			\$542
35	TOTAL COST			-	-	\$10,252	-	-	\$3,250

ENGINEER'S OPINION OF PROBABLE COST											
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade		SHEET	1	OF	1				
ENGINEER		E M C Engineers, Inc. Denver, CO		DATE PREPARED		1-Mar-95					
				ESTIMATOR		C. Wohler					
				CHECKED BY		A. Niemeyer					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL	
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total		
1		BUILDING 7485									
2		NON-RECURRING									
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31		SUBTOTAL				\$0				\$0	
32	OH	OVERHEAD			17%	\$0				\$0	
33	PRO	PROFIT			10%	\$0				\$0	
34	CONT	CONTINGENCY			20%	\$0				\$0	
35		TOTAL COST				\$0				\$0	

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				DATE PREPARED		1 OF 1	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR		1-Mar-95	
						CHECKED BY		C. Wohler	
						A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 7485							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0

DEMAND LIMITING ANALYSIS BUILDING 7485

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14943	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	15.52	15.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.33
CAPACITY (KW)	32456	34436	26136	20754	26400	22752	27108	25812	23310	21834	21996	30079
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32718	34749	26373	20775	26453	22820	27244	25916	23404	21878	22084	30444
80% SUMMER PEAK (KVA)	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32718	34749	27799	27799	27799	27799	27799	27799	27799	27799	27799	30444
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$.05	\$130,078.81	\$138,303.42	\$110,156.73	\$110,156.73	\$110,156.73	\$110,156.73	\$110,156.73	\$110,156.73	\$110,156.73	\$110,156.73	\$110,156.73	\$120,868.19
(SUB DISCOUNT \$.20	(\$6,543.64)	(\$6,949.80)	(\$5,559.84)	(\$5,559.84)	(\$5,559.84)	(\$5,559.84)	(\$5,559.84)	(\$5,559.84)	(\$5,559.84)	(\$5,559.84)	(\$5,559.84)	(\$6,088.80)
CAPACITY CHARGE	\$126,125.16	\$133,943.62	\$107,186.89	\$107,186.89	\$107,186.89	\$107,186.89	\$107,186.89	\$107,186.89	\$107,186.89	\$107,186.89	\$107,186.89	\$117,369.39
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,193.15	\$68,177.52	\$54,542.02	\$54,542.02	\$54,542.02	\$54,542.02	\$54,542.02	\$54,542.02	\$54,542.02	\$54,542.02	\$54,542.02	\$59,731.12
100*KVA @ \$.03404	\$111,372.83	\$118,285.57	\$94,628.45	\$94,628.45	\$94,628.45	\$94,628.45	\$94,628.45	\$94,628.45	\$94,628.45	\$94,628.45	\$94,628.45	\$103,631.37
250*KVA @ \$.03084	\$252,257.50	\$267,914.72	\$210,024.13	\$184,118.53	\$214,331.78	\$214,331.78	\$214,331.78	\$214,331.78	\$214,331.78	\$212,799.73	\$171,165.73	\$234,723.22
EXCESS @ \$.02864	\$109,768.83	\$65,883.55	\$0.00	\$0.00	\$1,154.84	\$51,847.64	\$42,396.44	\$32,945.24	\$38,959.64	\$0.00	\$0.00	\$28,422.37
ENERGY CHARGE	\$537,592.32	\$520,261.37	\$359,194.60	\$333,289.00	\$364,657.09	\$415,349.89	\$405,898.69	\$396,447.49	\$402,461.89	\$361,970.20	\$320,336.20	\$426,508.07
TOTAL CHARGE LESS ECA	\$663,717.48	\$654,204.98	\$466,381.50	\$440,475.90	\$471,843.99	\$522,536.79	\$513,085.59	\$503,634.39	\$509,648.79	\$469,157.10	\$427,523.10	\$543,877.46
SUMMARY												
MONTHLY DIFFERENCE	\$85.59	\$86.93	\$58.36	\$58.36	\$69.55	\$69.55	\$69.55	\$69.55	\$69.55	\$58.36	\$58.36	\$95.95
ANNUAL DIFFERENCE.....		\$849.63										

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 23 RECTANGULAR 23 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - G L A S S - - -	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - W A L L - - -	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
N_OLD_SPAC		0.000	0.000	0.00	0.236	0.236	3102.00	0.236	3102.00	NORTH
N_NEW_SPAC		0.000	0.000	0.00	0.060	0.060	2332.00	0.060	2332.00	NORTH
S_OLD_SPAC		0.000	0.000	0.00	0.060	0.060	660.00	0.060	660.00	EAST
S_NEW_SPAC		0.000	0.000	0.00	0.060	0.060	660.00	0.060	660.00	EAST
E_OLD_SPAC		0.000	0.000	0.00	0.060	0.060	2024.00	0.060	2024.00	EAST
E_NEW_SPAC		0.000	0.000	0.00	0.236	0.236	2024.00	0.236	2024.00	EAST
S_OLD_SPAC		1.021	167.62	0.00	0.060	0.060	1592.38	0.151	1760.00	SOUTH
S_NEW_SPAC		1.021	174.24	0.00	0.236	0.236	2355.76	0.290	2530.00	SOUTH
W_OLD_SPAC		0.000	0.00	0.00	0.236	0.236	2068.00	0.236	2068.00	WEST
W_NEW_SPAC		0.000	0.00	0.00	0.236	0.236	660.00	0.236	660.00	WEST
N_OLD_SPAC		0.000	0.00	0.00	0.060	0.060	198.00	0.060	198.00	WEST
N_NEW_SPAC		0.000	0.00	0.00	0.236	0.236	352.00	0.236	352.00	WEST
CR_OLD_SPAC		0.000	0.00	0.00	0.028	0.028	3180.00	0.028	3180.00	ROOF
CR_NEW_SPAC		0.000	0.00	0.00	0.074	0.074	7728.00	0.074	7728.00	ROOF
S_OLD_SPAC		0.000	0.00	0.00	0.028	0.028	7728.00	0.028	7728.00	ROOF
S_NEW_SPAC		0.000	0.00	0.00	0.074	0.074	2520.00	0.074	2520.00	ROOF
W_OLD_SPAC		0.000	0.00	0.00	0.028	0.028	2712.00	0.028	2712.00	ROOF
W_NEW_SPAC		0.000	0.00	0.00	0.074	0.074	1504.00	0.074	1504.00	ROOF
CR_OLD_SPAC		0.000	0.00	0.00	0.074	0.074	11750.00	0.074	11750.00	ROOF
CR_NEW_SPAC		0.000	0.00	0.00	0.074	0.074	3765.00	0.074	3765.00	ROOF
S_OLD_SPAC		0.000	0.00	0.00	0.028	0.028	2024.00	0.028	2024.00	ROOF
S_NEW_SPAC		0.000	0.00	0.00	0.074	0.074	2024.00	0.074	2024.00	ROOF
E_OLD_SPAC		0.000	0.00	0.00	0.074	0.074	2024.00	0.074	2024.00	ROOF
E_NEW_SPAC		0.000	0.00	0.00	0.074	0.074	2024.00	0.074	2024.00	ROOF

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

N_OLD_SPAC	0.000	0.00	0.074	2256.00	0.074	2256.00	ROOF
N_NEW_SPAC	0.000	0.00	0.020	2256.00	0.020	2256.00	UNDERGRND
CR_OLD_SPAC	0.000	0.00	0.020	11750.00	0.020	11750.00	UNDERGRND
CR_NEW_SPAC	0.000	0.00	0.020	3765.00	0.020	3765.00	UNDERGRND
S_OLD_SPAC	0.000	0.00	0.020	1504.00	0.020	1504.00	UNDERGRND
S_NEW_SPAC	0.000	0.00	0.020	3180.00	0.020	3180.00	UNDERGRND
W_OLD_SPAC	0.000	0.00	0.020	7728.00	0.020	7728.00	UNDERGRND
W_NEW_SPAC	0.000	0.00	0.020	7728.00	0.020	7728.00	UNDERGRND
CR_OLD_SPAC	0.000	0.00	0.020	7728.00	0.020	7728.00	UNDERGRND
CR_NEW_SPAC	0.000	0.00	0.020	2520.00	0.020	2520.00	UNDERGRND
S_OLD_SPAC	0.000	0.00	0.020	2712.00	0.020	2712.00	UNDERGRND
S_NEW_SPAC	0.000	0.00	0.020	2024.00	0.020	2024.00	UNDERGRND
E_OLD_SPAC	0.000	0.00	0.020	2024.00	0.020	2024.00	UNDERGRND
E_NEW_SPAC	0.000	0.00	0.020	2024.00	0.020	2024.00	UNDERGRND

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.000	0.160	0.160	0.00	5434.00	5434.00
EAST	0.000	0.126	0.126	0.00	5368.00	5368.00
SOUTH	1.021	0.165	0.233	341.86	3948.14	4290.00
WEST	0.000	0.225	0.225	0.00	3278.00	3278.00
ROOF	0.000	0.059	0.059	0.00	47191.00	47191.00
ALL WALLS	1.021	0.163	0.179	341.86	18028.14	18370.00
WALLS+ROOFS	1.021	0.088	0.092	341.86	65219.14	65561.00
UNDERGRND	0.000	0.020	0.020	0.00	52895.00	52895.00
BUILDING	1.021	0.057	0.060	341.86	118114.14	118456.00

EMC ENGINEERS INC. EZZOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 34916 SQFT 3244 SQMT
VOLUME 768152 CUFT 21754 CUMT

TIME JUL 23 8PM
DRY-BULB TEMP 91F 33C
WET-BULB TEMP 77F 25C
COOLING LOAD
HEATING LOAD
JAN 15 7AM
-7F -22C
-8F -22C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	57.468	16.831	0.000	0.000	-224.260	-65.680
ROOFS	104.978	30.745	0.000	0.000	-237.339	-69.511
GLASS CONDUCTION	5.365	1.571	0.000	0.000	-24.792	-7.261
GLASS SOLAR	19.927	5.836	0.000	0.000	0.878	0.257
DOOR	0.188	0.055	0.000	0.000	-0.747	-0.219
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-9.497	-2.781	0.000	0.000	-30.373	-8.896
OCCUPANTS TO SPACE	96.973	28.401	177.967	52.122	11.021	3.228
LIGHT TO SPACE	130.067	38.093	0.000	0.000	33.017	9.670
EQUIPMENT TO SPACE	27.077	7.930	0.000	0.000	4.071	1.192
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	2.439	0.714	5.016	1.469	-1.246	-0.365
TOTAL	434.985	127.396	182.983	53.591	-469.771	-137.584
TOTAL LOAD	617.968	KBTU/H	180.987	KW	-469.771	KBTU/H
TOTAL LOAD / AREA	17.70	BTU/H.SQFT	55.795	W /SQMT	13.45	BTU/H.SQFT
						W /SQMT

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 SDL RUN 1											
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY TOPEKA, KS											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR OLD_SYSTEM											
- - - - - C O O L I N G - - - - - H E A T I N G - - - - - E L E C - - - - -											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-101.104	15	7	-7.F	-341.887	25782.	45.178
FEB	0.00000				-70.502	3	7	-6.F	-307.841	23218.	45.178
MAR	0.00000				-46.658	3	7	14.F	-231.875	25857.	45.178
APR	0.00000				-7.249	5	7	30.F	-130.964	25125.	45.178
MAY	69.04465	16	2	62.F	-0.642	1	2	44.F	-13.237	25601.	45.178
JUN	154.16762	24	20	83.F	0.000				0.000	25020.	45.178
JUL	191.51065	17	19	88.F	0.000				0.000	25707.	45.178
AUG	184.86569	20	21	87.F	0.000				0.000	25857.	45.178
SEP	119.15224	5	18	90.F	0.000				0.000	24945.	45.178
OCT	3.05387	1	18	83.F	-4.357	20	7	23.F	-112.773	25654.	45.178
NOV	0.00000				-33.403	3	6	13.F	-221.007	24711.	45.178
DEC	0.00000				-85.016	13	7	2.F	-291.093	25835.	45.178
TOTAL	721.795				-348.931					303316.	
MAX									-341.887		45.178

D-24

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 SDL RUN 1												
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY TOPEKA, KS												
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR OLD_SYSTEM												
- - - - - N U M B E R O F H O U R S - - - - -												
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-65.977	42.228
FEB	0	672	0	0	672	0	672	0	0	0	-63.295	42.228
MAR	0	744	0	0	744	0	744	0	0	0	-63.984	42.228
APR	0	720	0	0	720	0	720	0	0	0	-4.214	42.883
MAY	384	360	0	0	360	384	744	0	0	0	0.000	17.440
JUN	720	0	0	0	0	720	720	0	0	0	0.000	45.178
JUL	744	0	0	0	0	744	744	0	0	0	0.000	44.359
AUG	744	0	0	0	0	744	744	0	0	0	0.000	45.178
SEP	716	0	0	4	0	720	720	0	0	4	0.000	44.359
OCT	20	720	0	4	720	24	744	0	0	4	0.000	44.359
NOV	0	720	0	0	720	0	720	0	0	0	-102.603	42.228
DEC	0	744	0	0	744	0	744	0	0	0	-97.331	43.539
ANNUAL	3328	5424	0	8	5424	3336	8760	0	0	8		

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR NEW_SYSTEM TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-102.975	15	7	-7.F	-8.F	17379.	29.532
FEB	0.00000				0.000	-76.214	3	7	-5.F	-6.F	15644.	29.532
MAR	0.00000				0.000	-56.715	3	7	14.F	12.F	17454.	29.532
APR	0.00000				0.000	-13.241	5	7	30.F	27.F	16941.	29.532
MAY	43.37738	31	19	84.F	76.F	-1.513	5	7	44.F	40.F	17249.	29.532
JUN	107.01460	24	20	83.F	74.F	0.000				0.000	16885.	29.532
JUL	137.89664	17	18	88.F	80.F	0.000				0.000	17305.	29.532
AUG	134.50307	20	21	87.F	75.F	0.000				0.000	17454.	29.532
SEP	80.65082	5	18	90.F	77.F	0.000				0.000	16810.	29.532
OCT	2.07053	1	18	83.F	68.F	-6.695	20	7	23.F	23.F	17277.	29.532
NOV	0.00000				0.000	-39.916	3	6	13.F	12.F	16652.	29.532
DEC	0.00000				0.000	-87.936	13	7	2.F	1.F	17407.	29.532
TOTAL MAX	505.513				327.021	-385.205				-316.706	204455.	29.532

D9-25

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 SDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR NEW_SYSTEM TOPEKA, KS

MONTH	HOURS COOLING LOAD		HOURS COINCIDENT COOL-HEAT LOAD		HOURS FLOATING		HOURS HEATING AVAIL.		HOURS COOLING AVAIL.		HOURS FANS ON		HOURS FANS ON CYCLE ON		HOURS NIGHT VENTING		HOURS FLOATING WHEN FANS ON		--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)		ELECTRIC LOAD AT COOLING PEAK (KW)	
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS COINCIDENT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)									
JAN	0	744	0	0	0	744	0	744	0	0	0	-84.085	29.532									
FEB	0	672	0	0	0	672	0	672	0	0	0	-87.891	29.532									
MAR	0	742	0	0	2	744	0	744	0	0	2	-88.245	29.532									
APR	0	524	0	0	196	720	0	720	0	0	196	-2.971	29.532									
MAY	381	216	0	0	147	360	384	744	0	0	147	0.000	29.532									
JUN	717	0	0	0	3	0	720	720	0	0	3	0.000	29.532									
JUL	744	0	0	0	0	0	744	744	0	0	0	0.000	29.532									
AUG	744	0	0	0	0	0	744	744	0	0	0	0.000	29.532									
SEP	691	0	0	0	29	0	720	720	0	0	29	0.000	29.532									
OCT	19	486	0	0	239	720	24	744	0	0	239	0.000	29.532									
NOV	0	660	0	0	60	720	0	720	0	0	60	-111.034	29.532									
DEC	0	744	0	0	0	744	0	744	0	0	0	-107.017	29.532									
ANNUAL	3296	4788	0	0	676	5424	3336	8760	0	0	676											

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 164.494 282.746 15/20	NATURAL-GAS 322.984 915.963 15/ 7
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	147.744 282.616 4/20	241.463 841.633 3/ 7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	161.537 280.773 4/22	174.193 659.346 4/ 7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	151.720 273.641 5/ 9	40.509 443.575 5/ 7
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	186.568 471.143 31/18	6.731 124.909 5/ 7
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	229.229 472.463 28/18	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	253.804 509.661 23/18	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	255.804 499.780 21/19	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	210.018 483.193 5/18	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	155.571 400.529 1/18	24.928 427.862 20/ 7
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	152.889 277.030 12/11	128.122 631.396 3/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	164.136 282.658 9/20	279.838 799.866 13/ 7
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	2233.514 509.661	1218.767 915.963

EMC ENGINEERS INC. 80227 EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	47.65	1218.76
SPACE COOL	386.55	0.00
HVAC AUX	859.06	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	805.78	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	134.53	0.00
TOTAL	2233.59	1218.76

TOTAL SITE ENERGY 3452.28 MBTU 98.0 KBTU/SQFT-YR GROSS-AREA 98.9 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 7926.02 MBTU 225.1 KBTU/SQFT-YR GROSS-AREA 227.0 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 41.7
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 15:32:30 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7485 BOWLING ALLEY
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR OLD_SYSTEM TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-138.261	15	7	-7.F	-8.F	13403.	28.541
FEB	0.00000				0.000	-104.617	3	7	-5.F	-6.F	12038.	28.541
MAR	0.00000				0.000	-82.691	3	7	14.F	12.F	13523.	30.677
APR	0.00000				0.000	-24.121	5	7	30.F	27.F	16178.	42.524
MAY	40.43390	16	2	62.F	59.F	-3.699	5	7	44.F	40.F	17170.	43.850
JUN	102.12167	24	20	83.F	74.F	0.000				0.000	14765.	42.538
JUL	139.73540	23	20	91.F	77.F	0.000				0.000	15103.	35.632
AUG	135.43437	20	20	90.F	75.F	0.000				0.000	15437.	34.994
SEP	68.64257	5	18	90.F	77.F	0.000				0.000	14472.	42.538
OCT	1.46984	1	20	70.F	64.F	-15.137	20	7	23.F	23.F	18137.	43.522
NOV	0.00000				0.000	-64.385	3	6	13.F	12.F	13499.	40.885
DEC	0.00000				0.000	-122.341	13	7	2.F	1.F	13456.	28.568
TOTAL	487.838					-555.251					177183.	
MAX					411.529					-372.470		43.850

D9-28

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 15:32:30 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7485 BOWLING ALLEY
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR OLD_SYSTEM TOPEKA, KS

MONTH	HOURS				NUMBER OF				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS				HOURS							
-------	-------	--	--	--	-----------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	-------	--	--	--	--	--	--	--

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 123.430 226.702 15/20	NATURAL-GAS 372.295 954.479 15/7
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	110.800 226.571 4/20	287.683 898.991 3/7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	121.297 226.545 4/20	226.116 710.631 4/7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	122.480 258.119 23/22	67.067 517.056 5/7
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	150.331 407.436 31/18	11.861 253.424 5/7
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	179.186 413.312 24/20	0.000 0.000 30/1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	202.617 456.684 23/18	0.000 0.000 31/1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	205.624 446.027 21/19	0.000 0.000 31/1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	159.688 418.390 5/18	0.000 0.000 30/1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	130.337 321.383 1/18	42.293 535.856 20/7
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	116.371 252.426 23/21	173.598 683.803 3/6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	123.237 226.613 9/20	330.364 848.492 13/7
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	1745.397 456.684	1511.277 954.479

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	57.17	1511.28
SPACE COOL	319.12	0.00
HVAC AUX	428.80	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	805.78	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	134.53	0.00
TOTAL	1745.40	1511.28

TOTAL SITE ENERGY 3256.67 MBTU 92.5 KBTU/SQFT-YR GROSS-AREA 93.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 6752.71 MBTU 191.8 KBTU/SQFT-YR GROSS-AREA 193.4 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 62.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 6914 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	581.63	378.42	203.21	145.23
Annual Natural Gas (MBTU)	573.02	578.97	-5.95	-4.25
Electric Demand June (KW)	53.52	52.06	1.46	1.04
Electric Demand July (KW)	55.05	54.80	0.25	0.18
Electric Demand August (KW)	56.69	57.50	-0.81	-0.58

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7108 (sq.ft.)	12179
ECO Model Bldg 6914 (sq.ft.)	8704
Square Footage Adjustment Factor	0.715

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005	
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995	
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohler

1. INVESTMENT: BLDG 6914 - Convert (2) Existing MZs to VAV AHUs

A. CONSTRUCTION COST	=		\$26,395
B. SIOH COST	(5.5% of 1A) =		\$1,452
C. DESIGN COST	(6.0% of 1A) =		\$1,584
D. TOTAL COST	(1A + 1B + 1C) =		\$29,431
E. SALVAGE VALUE OF EXISTING EQUIPMENT =			\$0
F. PUBLIC UTILITY COMPANY REBATE =			\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =		-----> \$29,431

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	145	\$1,757	15.88	\$27,906
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(4)	(\$18)	18.30	(\$320)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			(\$18)	14.88	(\$263)
F. TOTAL		141	\$1,722		-----> \$27,322

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	\$0	14.88	\$0
2		\$0	14.88	\$0
3		\$0	14.88	\$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST (-)	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0
b.				\$0
c.				\$0
d. TOTAL	\$0			\$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = \$0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bd1/Economic Life)) \$1,722

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 17.09

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$27,322

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 0.93

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST

PROJECT Fort Riley Feasibility Study for HVAC Upgrade
ENGINEER E M C Engineers, Inc.
Denver, CO

SHEET 1 OF 1
DATE PREPARED 4-May-95
ESTIMATOR C. Wohler
CHECKED BY A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 6914								
2		PROPOSED SYSTEM MODIFICATIONS								
3										
4										
5	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER, 7.5HP	EA.	1.0	\$2,728.70	\$2,729	1-ELEC	12.5	\$262	\$2,990
6	VSD10	VARIABLE SPEED DRIVE W/ CONTRLER, 10HP	EA.	1.0	\$3,197.70	\$3,198	1-ELEC	12.5	\$262	\$3,459
7	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	11.0	\$24.23	\$266	1-ELEC	0.8	\$184	\$451
8	WIRE#12	COPPER WIRING #12	C.L.F.	13.0	\$7.41	\$96	1-ELEC	0.727	\$198	\$294
9	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	8.0	\$271.32	\$2,171	1-SHEE	1.13	\$188	\$2,359
10	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	3.0	\$279.07	\$837	1-SHEE	1.22	\$76	\$913
11	REHEAT1.5	REHEAT COIL, 2ROW, 1.5"x1"	EA.	7.0	\$129.36	\$906	Q-5	1.32	\$179	\$1,085
12	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	3.0	\$138.57	\$416	Q-5	1.32	\$77	\$492
13	REHEAT3	REHEAT COIL, 2ROW, 3"x1"	EA.	1.0	\$154.07	\$154	Q-5	1.32	\$26	\$180
14	CNTV0.75	CONTROL VALVE 3/4"	EA.	11.0	\$153.10	\$1,684	1-PLUM	0.444	\$105	\$1,789
15	STLPI1	STEEL PIPE SCH. 40, 1" WHANGERS	L.F.	400.0	\$2.10	\$841	Q-1	0.151	\$1,171	\$2,012
16	INSLPI1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	400.0	\$0.62	\$248	Q-14	0.073	\$538	\$786
17	ELE-SWIT	DDC SWITCH	EA.	1.0	\$69.77	\$70	1-STPI	0.5	\$11	\$81
18										
19										
20										
21										
22										
23										
24										
25										
26		EXISTING SYSTEMS DEMOLITION	EA.	11.0			1-SHEE	1	\$229	\$229
27		ZONE DUCTWORK DEMOLITION								
28										
29										
30										
31		SUBTOTAL				\$13,615				\$17,120
32	OH	OVERHEAD			17%	\$2,287				\$2,876
33	PRO	PROFIT			10%	\$1,590				\$2,000
34	CONT	CONTINGENCY			20%	\$3,499				\$4,399
35	TOTAL COST					\$20,992			\$5,404	\$26,395

ENGINEER'S OPINION OF PROBABLE COST											
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade									
ENGINEER		E M C Engineers, Inc. Denver, CO									
		SHEET 1		OF 1		DATE PREPARED		1-Mar-95		ESTIMATOR	
						C. Wohler		CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL	
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total		
1		BUILDING 6914									
2		NON-RECURRING									
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31		SUBTOTAL				\$0				\$0	\$0
32	OH	OVERHEAD			17%	\$0				\$0	\$0
33	PRO	PROFIT			10%	\$0				\$0	\$0
34	CONT	CONTINGENCY			20%	\$0				\$0	\$0
35		TOTAL COST				\$0				\$0	\$0

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED		1-Mar-95	
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR		C. Wohler	
										CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			Total	TOTAL		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total				
1		BUILDING 6914											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0		\$0		
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0		\$0		
30													
31													
32													
33													
34													
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0		\$0		

DEMAND LIMITING ANALYSIS BUILDING 6914

SUMMER PEAK (KW) = 27812	JUL BILL 7/1-8/2 ACTUAL	AUG BILL 8/2-9/1 ACTUAL	SEP BILL 9/3-10/1 ACTUAL	OCT BILL 10/1-11/1 ACTUAL	NOV BILL 11/1-12/1 ACTUAL	DEC BILL 12/1-1/3 ACTUAL	JAN BILL 1/4-2/1 ACTUAL	FEB BILL 2/1-3/1 ACTUAL	MAR BILL 3/3-4/1 ACTUAL	APR BILL 4/1-5/3 ACTUAL	MAY BILL 5/3-6/1 ACTUAL	JUN BILL 6/1-7/1 ACTUAL
	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.80%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,488.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	0.18	(0.58)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04
CAPACITY (KW)	32472	34453	26136	20754	26400	22752	27108	25812	23310	21834	21996	30095
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.80%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30460
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30460
ACTUAL OR 80% PEAK	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,141.44	\$138,370.13	\$110,210.11	\$110,210.11	\$110,210.11	\$110,210.11	\$110,210.11	\$110,210.11	\$110,210.11	\$110,210.11	\$110,210.11	\$120,934.96
SUB DISCOUNT \$.20	(\$6,546.74)	(\$6,953.09)	(\$5,562.47)	(\$5,562.47)	(\$5,562.47)	(\$5,562.47)	(\$5,562.47)	(\$5,562.47)	(\$5,562.47)	(\$5,562.47)	(\$5,562.47)	(\$6,092.10)
CAPACITY CHARGE	\$126,184.70	\$134,007.04	\$107,237.63	\$107,237.63	\$107,237.63	\$107,237.63	\$107,237.63	\$107,237.63	\$107,237.63	\$107,237.63	\$107,237.63	\$117,432.86
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.50	\$68,209.84	\$54,567.87	\$54,567.87	\$54,567.87	\$54,567.87	\$54,567.87	\$54,567.87	\$54,567.87	\$54,567.87	\$54,567.87	\$59,763.47
100*KVA @ \$.03404	\$111,425.48	\$118,341.64	\$94,673.31	\$94,673.31	\$94,673.31	\$94,673.31	\$94,673.31	\$94,673.31	\$94,673.31	\$94,673.31	\$94,673.31	\$103,687.49
250*KVA @ \$.03084	\$252,376.74	\$268,041.74	\$209,963.17	\$184,057.57	\$214,433.39	\$214,433.39	\$214,433.39	\$214,433.39	\$214,433.39	\$212,738.77	\$171,104.77	\$234,850.33
EXCESS @ \$.02864	\$109,591.66	\$65,694.83	\$0.00	\$0.00	\$1,003.87	\$51,696.67	\$42,245.47	\$32,794.27	\$38,808.67	\$0.00	\$0.00	\$28,233.50
ENERGY CHARGE	\$537,617.38	\$520,288.05	\$359,204.36	\$333,298.76	\$364,678.44	\$415,371.24	\$405,920.04	\$396,468.84	\$402,483.24	\$361,979.96	\$320,345.96	\$426,534.78
TOTAL CHARGE LESS ECA	\$663,802.08	\$654,295.09	\$466,441.99	\$440,536.39	\$471,916.07	\$522,608.87	\$513,157.67	\$503,706.47	\$509,720.87	\$469,217.59	\$427,583.59	\$543,967.65
SUMMARY												
MONTHLY DIFFERENCE	\$1.00	(\$3.18)	(\$2.13)	(\$2.13)	(\$2.54)	(\$2.54)	(\$2.54)	(\$2.54)	(\$2.54)	(\$2.13)	(\$2.13)	\$5.77
ANNUAL DIFFERENCE.....		(\$17.66)										

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 EDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914 EXCHANGE MAIN RETAIL TOPEKA, KS
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

NUMBER OF EXTERIOR SURFACES 14 RECTANGULAR 14 OTHER 0 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)											
SURFACE	SPACE	- - - G L A S S - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - W A L L - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH			
	SPACE 1	0.000	0.00	0.065	190.00	0.065	190.00	NORTH			
	SPACE_3	0.000	0.00	0.065	360.00	0.065	360.00	NORTH			
	SPACE_4	0.000	0.00	0.065	220.00	0.065	220.00	NORTH			
	PLENUM 1	0.000	0.00	0.094	429.00	0.094	429.00	NORTH			
	SPACE 4	0.000	0.00	0.103	420.00	0.103	420.00	EAST			
	PLENUM 1	0.000	0.00	0.094	924.00	0.094	924.00	EAST			
	SPACE 1	0.490	133.65	0.103	1136.35	0.144	1270.00	EAST			
	SPACE_2	0.000	0.00	0.065	420.00	0.065	420.00	SOUTH			
	PLENUM 1	0.000	0.00	0.094	429.00	0.094	429.00	SOUTH			
	SPACE 1	0.000	0.00	0.065	360.00	0.065	360.00	SOUTH			
	PLENUM 1	0.000	0.00	0.094	924.00	0.094	924.00	WEST			
	SPACE 2	0.490	74.25	0.103	695.75	0.141	770.00	WEST			
	SPACE_3	0.490	29.70	0.103	880.30	0.116	910.00	WEST			
	PLENUM 1	0.000	0.00	0.128	17160.00	0.128	17160.00	ROOF			
	SPACE 1	0.000	0.00	0.020	4445.00	0.020	4445.00	UNDERGRND			
	SPACE_2	0.000	0.00	0.020	3234.00	0.020	3234.00	UNDERGRND			
	SPACE_3	0.000	0.00	0.020	3570.00	0.020	3570.00	UNDERGRND			
	SPACE_4	0.000	0.00	0.020	924.00	0.020	924.00	UNDERGRND			

D9-3

D9-37

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914 EXCHANGE MAIN RETAIL TOPEKA, KS
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

NUMBER OF EXTERIOR SURFACES 14 RECTANGULAR 14 OTHER 0 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)							
SURFACE	SPACE	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH		0.000	0.076	0.076	0.00	1199.00	1199.00
EAST		0.490	0.100	0.120	133.65	2480.35	2614.00
SOUTH		0.000	0.076	0.076	0.00	1209.00	1209.00
WEST		0.490	0.100	0.115	103.95	2500.05	2604.00
ROOF		0.000	0.128	0.128	0.00	17160.00	17160.00
ALL WALLS		0.490	0.092	0.104	237.60	7388.40	7626.00
WALLS+ROOFS		0.490	0.117	0.120	237.60	24548.40	24786.00
UNDERGRND		0.000	0.020	0.020	0.00	12173.00	12173.00
BUILDING		0.490	0.085	0.087	237.60	36721.40	36959.00

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 40.189 97.975 31/11	NATURAL-GAS 136.994 339.352 15/ 8
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	36.203 97.975 28/11	105.060 301.456 3/ 5
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	40.856 97.975 31/10	81.006 253.804 14/ 4
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	36.709 97.975 15/ 8	26.754 183.724 5/ 5
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.449 183.475 31/18	5.682 128.996 9/ 5
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	65.374 182.657 28/16	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	70.682 187.901 22/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	74.395 193.495 11/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	54.750 183.507 7/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	36.540 97.975 20/10	23.955 238.275 2/ 2
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	37.350 97.975 30/12	69.199 245.711 3/ 5
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	40.128 97.975 30/18	124.365 296.580 15/ 5
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	581.624 193.495	573.016 339.352

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914 EXCHANGE MAIN RETAIL
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	20.56	573.02
SPACE COOL	125.35	0.00
HVAC AUX	223.60	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	182.00	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	30.11	0.00
TOTAL	581.63	573.02

TOTAL SITE ENERGY 1154.64 MBTU 94.1 KBTU/SQFT-YR GROSS-AREA 94.8 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 2319.63 MBTU 189.0 KBTU/SQFT-YR GROSS-AREA 190.5 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 1.4
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 6/1995 8:26:52 SDL RUN 1											
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6914 EXCHANGE MAIN RETAIL											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-FAN-VAV TOPEKA, KS											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-95.697	15	-8.F	-9.F	-191.818	5413.	20.039
FEB	0.00000				-75.433	3	-5.F	-6.F	-181.671	4897.	20.039
MAR	0.00000				-60.071	4	14.F	12.F	-155.752	5980.	26.450
APR	0.00000				-22.880	5	31.F	29.F	-127.864	6275.	26.597
MAY	20.47546	31 18	90.F	76.F	-5.730	1 7	38.F	36.F	-94.680	6727.	26.597
JUN	56.79328	29 15	88.F	75.F	0.000				0.000	6799.	26.597
JUL	73.85205	7 18	83.F	74.F	0.000				0.000	6356.	26.597
AUG	76.74973	4 17	92.F	70.F	0.000				0.000	7267.	26.597
SEP	33.32541	7 16	93.F	76.F	0.000				0.000	6318.	26.597
OCT	0.00523	1 19	81.F	66.F	-20.858	20 5	25.F	25.F	-135.271	6045.	26.597
NOV	0.00000				-51.876	3 6	13.F	12.F	-154.913	5347.	26.597
DEC	0.00000				-87.578	13 8	0.F	-1.F	-177.875	5413.	20.039
TOTAL	261.201				-420.124					72838.	
MAX									-191.818		26.597

D9-4

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 6/1995 8:26:52 SDL RUN 1													
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6914 EXCHANGE MAIN RETAIL													
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-FAN-VAV TOPEKA, KS													
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	N U M B E R O F				H O U R S				--COINCIDENT LOADS--	
				HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		
JAN	0	744	0	0	744	0	0	0	0	-128.732	0.317		
FEB	0	672	0	0	672	0	0	0	0	-127.250	0.317		
MAR	0	744	0	0	744	0	0	0	0	-119.578	0.317		
APR	0	720	0	0	720	0	0	0	0	-45.637	0.317		
MAY	271	360	0	113	360	384	0	0	113	0.000	24.930		
JUN	615	0	0	105	0	720	0	0	105	0.000	25.411		
JUL	699	0	0	45	0	744	0	0	45	0.000	26.597		
AUG	696	0	0	48	0	744	0	0	48	0.000	26.597		
SEP	442	0	0	278	0	720	0	0	278	0.000	25.124		
OCT	3	720	0	21	720	24	0	0	21	0.000	0.317		
NOV	0	720	0	0	720	0	0	0	0	-136.221	0.317		
DEC	0	744	0	0	744	0	0	0	0	-136.104	0.317		
ANNUAL	2726	5424	0	610	5424	3336	8760	0	610				

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 22.224 73.496 31/18	NATURAL-GAS 128.095 241.237 15/ 6
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	20.083 73.496 28/14	103.311 230.554 3/ 7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.716 91.249 9/18	85.114 202.787 4/ 7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.518 92.096 20/12	35.661 172.139 5/ 5
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	32.545 175.566 31/18	9.698 134.629 1/ 7
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	46.551 177.680 28/17	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	51.328 187.037 13/17	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	56.220 196.245 11/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	36.063 176.875 7/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	22.712 92.372 13/ 8	33.067 180.357 20/ 5
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	21.277 91.748 23/18	74.231 201.877 3/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	22.182 73.496 30/18	118.790 226.530 13/ 8
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	378.419 196.245	587.966 241.237

ENERGY TYPE			
IN SITE MBTU -			
CATEGORY OF USE	ELECTRICITY	NATURAL-GAS	
SPACE HEAT	17.53	587.97	
SPACE COOL	97.13	0.00	
HVAC AUX	51.64	0.00	
DOM HOT WTR	0.00	0.00	
AUX SOLAR	0.00	0.00	
LIGHTS	182.00	0.00	
VERT TRANS	0.00	0.00	
MISC EQUIP	30.12	0.00	
TOTAL	378.42	587.97	

TOTAL SITE ENERGY
TOTAL SOURCE ENERGY
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

966.39 MBTU
1724.36 MBTU
140.5 KBTU/SQFT-YR GROSS-AREA
24.0
0.0
78.7 KBTU/SQFT-YR GROSS-AREA
141.6 KBTU/SQFT-YR NET-AREA
79.3 KBTU/SQFT-YR NET-AREA

BUILDING 6940 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1026.50	732.00	294.5	706.2
Annual Natural Gas (MBTU)	3939.20	716.66	3222.5	7727.3
Electric Demand June (KW)				
Electric Demand July (KW)				
Electric Demand August (KW)				

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8069 (sq.ft.)	6600
ECO Model Bldg 6940 (sq.ft.)	15826
Square Footage Adjustment Factor	2.398

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 6940 - Replace H&V Unit with Pool Heat Recovery Unit

A. CONSTRUCTION COST	=		\$178,678
B. SIOH COST	(5.5% of 1A) =		\$9,827
C. DESIGN COST	(6.0% of 1A) =		\$10,721
D. TOTAL COST	(1A + 1B + 1C) =		\$199,226
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=		\$0
F. PUBLIC UTILITY COMPANY REBATE	=		\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =		-----> \$199,226

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	706	\$8,545	15.88	\$135,695
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	7,727	\$31,836	18.30	\$582,608
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$0	14.88	\$0
F. TOTAL		8,434	\$40,381		-----> \$718,302

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	\$0	14.88	\$0
2		\$0	14.88	\$0
3		\$0	14.88	\$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$0			\$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$40,381
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	4.93
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$718,302
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	3.61

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
SHEET		1		OF		1			
DATE PREPARED		4-May-95							
ESTIMATOR		C. Wohler							
CHECKED BY		A. Niemeyer							
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 6940							
2		PROPOSED SYSTEM MODIFICATIONS							
3		NEW SYSTEMS INSTALLATION							
4		Z-PACK Heat Recovery Unit, 24,800 CFM	EA.	1.0	\$100,600	\$100,600	Q-6	100	\$2,011
5		STEEL PIPE SCH. 40, 3" WHANGERS	L.F.	45.0	\$6.40	\$288	Q-15	0.372	\$325
6	STLPIP3	FITTINGS, 5%				\$14			\$16
7		CONTROL VALVE 2-1/2"	EA.	1.0	\$935.09	\$935	1-PLUM	3.556	\$77
8	CNTV2.5	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	45.0	\$1.66	\$75	Q-14	0.094	\$78
9	INSLPIP3	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	2600	\$0.45	\$1,159	Q-10	0.087	\$4,395
10	DUCT5000	ALUMINUM GALV. ROOF INTAKE, 25,000 CFM	EA.	1.0	\$3,972.90	\$3,973	Q-9	17.778	\$333
11	ROFEXH25	ROOF PENETRATION	EA.	1.0			Q-5	32	\$620
12		SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	\$24.23	\$24	1-ELEC	0.8	\$17
13	E-TSTAT1	COPPER WIRING #12	C.L.F.	1.0	\$7.41	\$7	1-ELEC	0.727	\$15
14	WIRE#12								
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27		EXISTING SYSTEMS DEMOLITION							
28		AHU DEMO	TON	2.0			Q-5	17.778	\$689
29		DUCT DEMO	TON	0.7			Q-5	17.778	\$241
30									
31		SUBTOTAL				\$107,075			\$8,817
32	OH	OVERHEAD			17%	\$17,989			\$1,481
33	PRO	PROFIT			10%	\$12,506			\$1,030
34	CONT	CONTINGENCY			20%	\$27,514			\$2,266
35	TOTAL COST					\$165,084			\$13,594
									\$115,892
									\$19,470
									\$13,536
									\$29,780
									\$178,678

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT Fort Riley Feasibility Study for HVAC Upgrade									
ENGINEER E M C Engineers, Inc. Denver, CO									
SHEET 1 OF 1		DATE PREPARED 6-Mar-95		ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST		Total	TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit		
1		BUILDING 6940							
2		NON-RECURRING							
3									
4		EXISTING SYSTEM REPLACEMENT							
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22		EXISTING SYSTEMS DEMOLITION							
23									
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL						\$0	\$0
32	OH	OVERHEAD			17%			\$0	\$0
33	PRO	PROFIT			10%			\$0	\$0
34	CON	CONTINGENCY			20%			\$0	\$0
35	TOTAL COST							\$0	\$0

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED		6-Mar-95	
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR		C. Wohlert	
										CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			Total			
				Quantity	Unit Cost	Unit	Crew/ Worker	Hours/ Unit	Total				
1		BUILDING 6940											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	-	-	-	-	\$0	-	\$0	\$0
16													
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	-	-	-	-	\$0	-	\$0	\$0
30													
31													
32													
33													
34		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	-	-	-	-	\$0	-	\$0	\$0
35													



BUILDING 8069 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1026.50	732.00	294.5	294.5
Annual Natural Gas (MBTU)	3939.20	716.66	3222.5	3222.5
Electric Demand June (KW)				
Electric Demand July (KW)				
Electric Demand August (KW)				

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8069 (sq.ft.)	6600
ECO Model Bldg 8069 (sq.ft.)	6600
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 8069 - Replace H&V Units with Pool Heat Recovery Units

A. CONSTRUCTION COST	=	\$155,877
B. SIOH COST	(5.5% of 1A) =	\$8,573
C. DESIGN COST	(6.0% of 1A) =	\$9,353
D. TOTAL COST	(1A + 1B + 1C) =	\$173,802
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$173,802

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	295	\$3,563	15.88	\$56,588
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	3,223	\$13,277	18.30	\$242,964
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$0	14.88	\$0
F. TOTAL		3,517	\$16,840		-----> \$299,551

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$0
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST				\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$35,706	5	0.863	\$30,814
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$35,706			\$30,814

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$30,814

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$18,625
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	9.33
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$330,365
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	1.90

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95			
ENGINEER E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 8069							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5		Z-PACK Heat Recovery Unit, 9,000 CFM	EA.	2.0	\$43,650	\$87,300	Q-6	63.37	\$2,548
6	STLPIP3	STEEL PIPE SCH. 40, 3" W/HANGERS	L.F.	200.0	\$6.40	\$1,279	Q-15	0.372	\$1,443
7		FITTINGS, 5%				\$64			\$72
8	INSLPIP3	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	200.0	\$1.66	\$331	Q-14	0.094	\$346
9	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	1260.0	\$0.47	\$586	Q-10	0.094	\$2,301
10	ROFEXH15	ALUMINUM GALV. ROOF INTAKE, 15,000 CFM	EA.	1.0	\$2,616.30	\$2,616	Q-9	12.3	\$231
11	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	\$24.23	\$24	1-ELEC	0.8	\$17
12	WIRE#12	COPPER WIRING #12	C.L.F.	1.0	\$7.41	\$7	1-ELEC	0.727	\$15
13		ROOF PENETRATION	EA.	2.0			Q-5	14	\$543
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27		EXISTING SYSTEMS DEMOLITION							
28		AHU DEMO	TON	4.0			Q-5	17.778	\$1,379
29									
30									
31		SUBTOTAL				\$92,208			\$8,895
32	OH	OVERHEAD			17%	\$15,491			\$1,494
33	PRO	PROFIT			10%	\$10,770			\$1,039
34	CONT	CONTINGENCY			20%	\$23,694			\$2,286
35	TOTAL COST					\$142,163			\$13,713
									\$101,103
									\$16,985
									\$11,809
									\$25,979
									\$155,877

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT				Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1	
ENGINEER				E M C Engineers, Inc.				DATE PREPARED 4-May-95	
				Denver, CO				ESTIMATOR C. Wohler	
								CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 8069							
2		NON-RECURRING							
3									
4		EXISTING SYSTEM REPLACEMENT							
5	AHU5400	5,400 CFM AHU, HEATING ONLY	EA.	4.0	\$3,803.33	\$15,213	Q-6	30	\$2,413
6	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	500.0	\$0.47	\$233	Q-10	0.098	\$952
7	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	120.0	\$2.56	\$307	Q-1	0.2	\$465
8		FITTINGS ADD 5%				\$15			\$23
9	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	\$1.40	\$167	Q-14	0.08	\$177
10	CNTV1	CONTROL VALVE 1"	EA.	4.0	\$190.89	\$764	1-PLUM	0.471	\$41
11	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	\$24.23	\$24	1-ELEC	0.8	\$17
12	WIRE#12	COPPER WIRING #12	C.L.F.	1.0	\$7.41	\$7	1-ELEC	0.727	\$15
13	DMP28X44	DAMPER W/ ACT, 28" X 44"	EA.	3.0	\$278.10	\$834	Q-9	2	\$112
14									
15									
16									
17									
18									
19									
20									
21									
22		EXISTING SYSTEMS DEMOLITION							
23		AHU DEMO	TON	4.0			Q-5	17.778	\$1,379
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$17,565			\$5,594
32	OH	OVERHEAD			17%	\$2,951			\$940
33	PRO	PROFIT			10%	\$2,052			\$653
34	CONT	CONTINGENCY			20%	\$4,514			\$1,437
35		TOTAL COST				\$27,081			\$8,625
									\$23,159
									\$3,891
									\$2,705
									\$5,951
									\$35,706

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED		4-Mar-95	
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR		C. Wohliert	
										CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL				
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	TOTAL			
1		BUILDING 8069											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	\$0	-	-	\$0	\$0			
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	\$0	-	-	\$0	\$0			
30													
31													
32													
33													
34													
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS		-	-	\$0	-	-	\$0	\$0			

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd. Suite C-200
Denver, CO 80227
(303) 988-2951

9755 Dogwood Rd. Suite 220
Roswell, GA 30075
(404) 642-1864

JOB 1406-005 HVAC Upgrade, FTR Inc, KS

SHEET NO. _____ OF _____

CALCULATED BY A. Niemeyer DATE 3/1/95

CHECKED BY _____ DATE _____

SCALE _____

BLDG. 8069 ENERGY CALCULATIONS

Baseline Energy Uses

	<u>ELEC. (MBTU)</u>	<u>N.G. (MBTU)</u>
EZDOE Baseline:	691.94	2379.36
Pool Htg. (hand calc.)	<u>334.60</u>	<u>1559.90</u>
TOTAL	<u>1026.5</u>	<u>3,939.2</u>

Heat Recovery System Energy Use:

	<u>ELEC. (MBTU)</u>	<u>N.G. (MBTU)</u>
EZDOE HRV Simulation	397.40	716.66
Pool Pump (hand calc.)	<u>334.60</u>	<u> </u>
	732.0	716.66

Pool Dehumidification / Heating / Heat Recovery Energy Use:

	<u>ELEC. (MBTU)</u>	<u>N.G. (MBTU)</u>
EZDOE HRV Simulation	397.40	716.66
Manf. Program for Martini 2000 Unit.	853.9	
Pool Pump. (hand calc.)	<u>334.60</u>	<u> </u>
	<u>1,585.9</u>	<u>716.66</u>

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd. 9755 Dogwood Rd.
 Suite C-200 Suite 220
 Denver, CO 80227 Roswell, GA 30075
 (303) 988-2951 (404) 642-1864

JOB 1406-005

SHEET NO. 1 OF 1

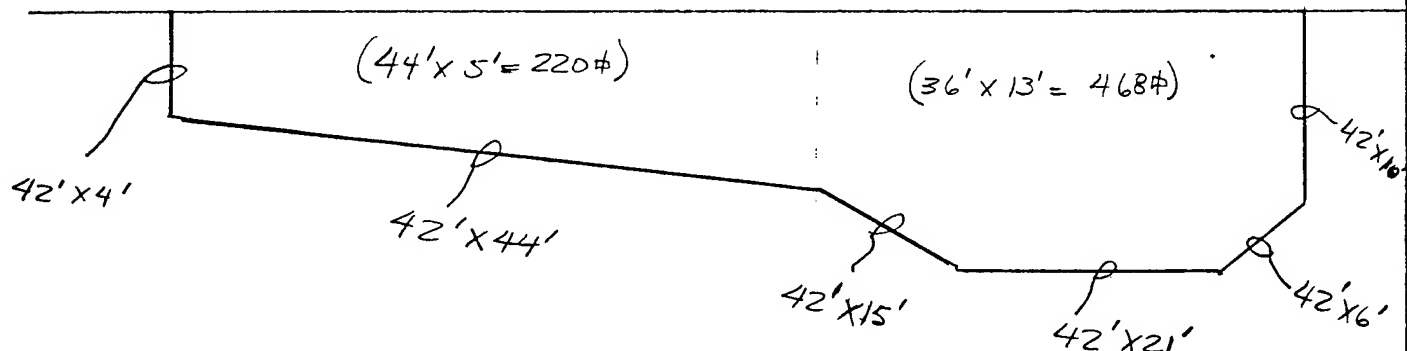
CALCULATED BY A. Niemeyer DATE 2-22-95

CHECKED BY DATE

SCALE

BLDG. 8069 SWIMMING POOL

82'LG X 42'WD

POOL BOTTOM & ENDS:

$$42' \times 100' = 4200 \text{ sq ft}$$

POOL SIDES:

$$220 \text{ sq ft} + 468 \text{ sq ft} = 688 \text{ sq ft}$$

$$688 \text{ sq ft} \times 2 = (1376 \text{ sq ft})$$

POOL SURFACE AREA:

$$82' \times 42' = 3444 \text{ sq ft}$$

ASSUMPTIONS:

- Pool Evap. rate is 164 lbs/hr (from Martini 2000 sizing program)
- U-Value of Bottom & Sides of Pool is 0.02 Btu/h/ft²/°F
- Avg. pool water temperature is 82°F.
- Avg. Ground temperature is 50°F
- Avg. space temperature is 80°F
- U-Value of surface water is 1.5 Btu/h/ft²/°F

POOL HEAT LOSSEVAPORATION:

$$164 \text{ lbs/hr} \times 1000 \text{ Btu/lbs}$$

$$= 164,000 \text{ Btu/h} \times 8760 \text{ hrs}$$

$$= 1,437 \text{ MBH/yr}$$

CONDUCTION (BOTTOM & SIDES OF POOL)

$$(0.02)(82-50^\circ\text{F})(5576 \text{ sq ft}) = 3569 \text{ Btu/h}$$

$$3569 \text{ Btu/h} \times 8760 \text{ hrs} = 31.3 \text{ MBH}$$

CONDUCTION (SURFACE OF WATER)

$$(1.5)(82-80^\circ\text{F})(3444 \text{ sq ft}) = 10,332 \text{ Btu/h}$$

$$10,332 \text{ Btu/h} \times 8760 \text{ hrs/yr.}$$

$$= 90.5 \text{ MBH}$$

$$\text{TOTAL MBH} = 1559.8 \text{ MBH}$$

TOTAL COST TO

$$\text{HEAT POOL} = 1559.8 \text{ MBH} \times \$4.12/\text{MBH}$$

$$\text{PER YR.} = \$6,422.00$$

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd. 9755 Dogwood Rd.
Suite C-200 Suite 220
Denver, CO 80227 Roswell, GA 30075
(303) 988-2951 (404) 642-1864

JOB 1406-005 HVAC Upgrade, Ft Riley KSSHEET NO. 1 OF 1CALCULATED BY A. Niemeyer DATE 3/1/95

CHECKED BY _____ DATE _____

SCALE _____

BLDG. 8069 Energy Calculations

Pool Htg. Electrical use:

15 HP pool pump operating year round.

$$15 \text{ HP} \times 746 \text{ W/HP} = 11,190 \text{ W}$$

$$11,190 \text{ W} \div 1000 \text{ W/KW} = 11.19 \text{ KW}$$

$$11.19 \text{ KW} \times 8760 \text{ HRS/yr} = 98,024.4 \text{ KWHR/yr}$$

$$98,024.4 \text{ KWHR/yr} \times 3413 \text{ BTU/KW} = 334,600,060 \text{ BTUH or}$$
$$334.6 \text{ MBH}$$

*** BUILDING ***

FLOOR AREA 6600 SQFT 613 SQMT
VOLUME 211200 CUFT 5981 CUMT

TIME DRY-BULB TEMP WET-BULB TEMP
JUL 23 6PM 95F 35C
COOLING LOAD 79F 26C
HEATING LOAD
JAN 4 3AM 8F -13C
7F -14C

	SENSIBLE (KBTU/H)	(KW)	LATENT (KBTU/H)	(KW)	SENSIBLE (KBTU/H)	(KW)
WALLS	3.296	0.965	0.000	0.000	-9.624	-2.819
ROOFS	22.895	6.705	0.000	0.000	-35.393	-10.366
GLASS CONDUCTION	32.167	9.421	0.000	0.000	-97.286	-28.492
GLASS SOLAR	111.103	32.539	0.000	0.000	3.427	1.004
DOOR	0.050	0.015	0.000	0.000	-0.135	-0.040
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.566	-0.166	0.000	0.000	-1.810	-0.530
OCCUPANTS TO SPACE	13.207	3.868	21.800	6.385	2.410	0.706
LIGHT TO SPACE	28.080	8.224	0.000	0.000	8.390	2.457
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	198.828	58.232	0.000	0.000
INFILTRATION	20.942	6.133	38.824	11.371	-125.891	-36.870
TOTAL	231.174	67.705	259.452	75.987	-255.910	-74.950
TOTAL LOAD	490.626	KBTU/H	143.692	KW	-255.910	KBTU/H
TOTAL LOAD / AREA	74.34	BTU/H.SQFT	234.347	W /SQMT	38.774	BTU/H.SQFT
						W /SQMT

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* LOADS *
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.24722	18 16	52.F	43.F	28.859	-73.182	4 3	8.F	7.F	-255.910	4199.	9.236
FEB	1.36480	13 16	58.F	48.F	59.207	-49.457	1 23	17.F	15.F	-204.686	3774.	9.236
MAR	9.20274	27 17	69.F	50.F	116.761	-35.871	3 8	15.F	12.F	-205.419	4239.	9.236
APR	30.67085	25 15	83.F	66.F	176.314	-10.922	4 4	33.F	31.F	-127.729	4088.	9.236
MAY	54.66166	31 17	90.F	76.F	216.780	-2.452	5 5	44.F	40.F	-81.912	4199.	9.236
JUN	70.07397	19 18	86.F	75.F	215.486	-0.435	2 5	50.F	49.F	-34.389	4082.	9.236
JUL	78.81918	23 17	95.F	79.F	231.174	-0.004	30 6	62.F	59.F	-4.167	4153.	9.236
AUG	76.94143	24 17	93.F	76.F	229.406	-0.080	4 6	54.F	53.F	-16.334	4291.	9.236
SEP	45.39871	6 16	93.F	75.F	218.245	-3.801	18 1	50.F	48.F	-70.688	4036.	9.236
OCT	23.49690	11 16	85.F	68.F	157.353	-12.606	20 7	23.F	22.F	-117.428	4153.	9.236
NOV	6.46319	7 15	73.F	58.F	92.995	-31.216	30 5	29.F	26.F	-150.566	4093.	9.236
DEC	0.33447	21 15	55.F	44.F	26.488	-67.893	15 5	8.F	7.F	-211.993	4147.	9.236
TOTAL	397.675					-287.917				-255.910	49454.	9.236
MAX					231.174							

D9-61

MESSAGE LIST FROM SYSTEMS PROGRAM

WARNING**
SYSTEM POOL-H&V'S MAY HAVE INADEQUATE HEATING CAPABILITY
(CHECK HEATING-CAPACITY,HEAT-SET-T,PRE-HEAT-T AND MAX-SUPPLY-T FOR CONSISTENCY)

SYSTEM NAME		ALTITUDE MULTIPLIER		RETURN FAN		DELTA-T (F)		ELEC (KW)		SUPPLY FLOW		EXHAUST FLOW		ZONE NAME	
POOL-H&V'S		1.040		0.		2.3		14.040		18720.		0.			
SUPPLY FAN				(CFM)		(F)		(KW)		(CFM)		(F)			
18720.				0.092		0.0		0.000		0.000		0.000			
				OUTSIDE AIR RATIO		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				0.092		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			
				1726.		0.0		0.000		1.000		0.			
				OUTSIDE AIR FLOW		DELTA-T (F)		ELEC (KW)		MINIMUM FLOW RATIO		EXHAUST FLOW			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1											
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POLSWIMMING POOL AREA											
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR POOL-H&V'S TOPEKA, KS											
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				-368.646	15	-8.F	-9.F	-933.079	14645.	23.276
FEB	0.00000				-280.547	3	-5.F	-6.F	-871.536	13209.	23.276
MAR	0.00000				-232.255	3	14.F	12.F	-660.015	14685.	23.276
APR	0.00000				-89.756	5	30.F	27.F	-438.189	14197.	23.276
MAY	0.00000				-25.859	1	37.F	37.F	-336.479	14645.	23.276
JUN	0.00000				0.000				0.000	14191.	23.276
JUL	0.00000				0.000				0.000	14598.	23.276
AUG	0.00000				0.000				0.000	14737.	23.276
SEP	0.00000				0.000				0.000	14145.	23.276
OCT	0.00000				-89.183	20	23.F	22.F	-524.764	14598.	23.276
NOV	0.00000				-197.197	3	13.F	12.F	-636.586	14202.	23.276
DEC	0.00000				-332.862	13	0.F	-1.F	-804.439	14593.	23.276
TOTAL	0.000				-1616.305				-933.079	172450.	23.276
MAX											

D9-62

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1											
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POLSWIMMING POOL AREA											
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR POOL-H&V'S TOPEKA, KS											
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	N U M B E R O F H O U R S	HOURS COOLING AVAIL.	HOURS HEATING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	-413.794	14.040
FEB	0	672	0	0	672	0	672	0	0	-419.951	14.040
MAR	0	738	0	6	744	0	744	0	6	-407.759	14.040
APR	0	629	0	91	720	0	720	0	91	-195.411	14.040
MAY	0	269	0	475	744	0	744	0	475	0.000	14.040
JUN	0	0	0	720	0	0	720	0	720	0.000	14.040
JUL	0	0	0	744	0	0	744	0	744	0.000	14.040
AUG	0	0	0	744	0	0	744	0	744	0.000	14.040
SEP	0	0	0	720	0	0	720	0	720	0.000	14.040
OCT	0	609	0	135	720	0	744	0	135	-308.676	14.040
NOV	0	696	0	24	720	0	720	0	24	-495.312	14.040
DEC	0	744	0	0	744	0	744	0	0	-471.069	14.040
ANNUAL	0	5101	0	3659	5424	0	8760	0	3659		

EMC ENGINEERS INC. DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1
DENVER, CO 80227
REPORT- SS-K SPACE TEMPERATURE SUMMARY POOL-H&V'S TOPEKA, KS
BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA

MONTH	A V E R A G E		S P A C E		T E M P		AVERAGE TEMPERATURE DIFFERENCE BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)		TEMPERATURE DIFFERENCE BETWEEN OUTDOOR& ROOM AIR FAN ON HOURS (F)		DIFFERENCE BETWEEN OUTDOOR& ROOM AIR FAN OFF HOURS (F)		SUMMED TEMP DIFFERENCE BETWEEN OUTDOOR& ROOM AIR HEATING HOURS (F)		HUMIDITY RATIO DIFFERENCE BETWEEN OUTDOOR AND ROOM AIR (FRAC.OR MULT.)	
	ALL HOURS (F)	COOLING HOURS (F)	HEATING HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)											
JAN	69.77		69.77	69.77	0.00		-43.96		-43.96		0.00		1362.63		1362.63	-0.00431
FEB	70.84		70.84	70.84	0.00		-39.16		-39.16		0.00		1096.42		1096.42	-0.00434
MAR	72.38		72.33	72.38	0.00		-32.11		-32.11		0.00		993.15		993.15	-0.00436
APR	75.80		75.10	75.80	0.00		-19.02		-19.02		0.00		535.82		535.82	-0.00444
MAY	76.94		76.73	76.94	0.00		-10.85		-10.85		0.00		201.44		201.44	-0.00346
JUN	79.92			79.92	0.00		-6.28		-6.28		0.00					-0.00243
JUL	83.52			83.52	0.00		-6.34		-6.34		0.00					-0.00246
AUG	85.00			85.00	0.00		-5.87		-5.87		0.00					-0.00246
SEP	72.90			72.90	0.00		-5.36		-5.36		0.00					-0.00235
OCT	75.17		74.52	75.17	0.00		-17.28		-17.28		0.00		500.99		536.49	-0.00447
NOV	72.51		72.33	72.51	0.00		-28.40		-28.40		0.00		845.39		852.01	-0.00445
DEC	70.08		70.08	70.08	0.00		-40.04		-40.04		0.00		1241.10		1241.10	-0.00430
ANNUAL	75.44	0.00	72.27	75.44	0.00		-21.14		-21.14		0.00		6776.92		7718.78	-0.00365

D9-63

```

3-----
EMC INC.
DENVER, CO 80227
ENGINEERS
EZDOE - ELITE SOFTWARE DEVELOPMENT INC
DOE-2.1D 3/ 1/1995
BASELINE SIMULATION FOR BLDG. #8069-POLSWIMMING POOL AREA
RELATIVE HUMIDITY SCATTER PLOT FOR POOL-H&V'S
TOPEKA, KS
15:57:20
SDL RUN 1

```

HOUR	TOTAL HOURS AT RELATIVE HUMIDITY LEVEL AND TIME OF DAY												TOTAL												
	1AM	2	3	4	5	6	7	8	9	10	11	12													
81-100	54	65	75	85	88	101	63	45	34	23	18	12	13	9	11	13	12	11	14	18	25	28	33	46	896
71-80	66	63	55	53	52	47	76	72	53	51	36	34	28	24	16	13	16	19	29	44	56	73	72	63	1111
61-70	48	43	44	38	46	41	42	63	75	61	64	51	44	40	34	38	35	42	52	67	62	52	53	55	1190
51-60	49	48	46	43	32	33	45	42	57	78	75	81	82	84	78	78	89	88	89	75	72	63	54	49	1530
41-50	81	76	75	81	81	79	78	83	88	90	107	116	120	119	123	118	109	115	109	93	82	82	83	84	2272
31-40	66	70	69	64	64	64	60	60	58	62	65	71	77	88	101	103	101	89	72	68	67	69	67	1743	
0-30	1	0	1	1	2	0	1	0	0	0	0	0	1	1	2	2	3	1	0	0	0	0	1	1	18

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- SS-O TEMPERATURE SCATTER PLOT POOL-H&V'S FOR pool-area TOPEKA, KS

HOUR	TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY												TOTAL
	1AM	2	3	4	5	6	7	8	9	10	11	12	
ABOVE 85	12	9	7	3	1	0	6	13	30	43	58	81	92
81-85	31	25	17	21	19	17	26	36	40	50	48	40	38
76-80	55	58	53	47	54	48	61	66	64	70	78	72	74
71-75	174	161	163	151	147	167	146	140	157	151	142	137	129
66-70	76	92	102	115	114	106	107	96	66	47	35	31	29
61-65	8	10	11	14	17	13	8	7	4	1	2	2	1
BELOW 60	9	10	12	14	13	14	11	7	4	3	2	2	2

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 PDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- PV-A EQUIPMENT SIZES TOPEKA, KS

EQUIPMENT	NUMBER		NUMBER		NUMBER		NUMBER		NUMBER		NUMBER	
	INSTD	AVAIL	INSTD	AVAIL	INSTD	AVAIL	INSTD	AVAIL	INSTD	AVAIL	INSTD	AVAIL
HW-BOILER	0.939	1	1									

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 PDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- PV-B COST REFERENCE DATA (USED FOR DEFAULT COSTS) TOPEKA, KS

EQUIPMENT	SIZE (MBTU)	UNIT COST (K\$)	INSTALD COST FACTOR	CONSUM-ABLES (\$/HR)	MAINT-NANCE (HRS/YR)	EQPMT LIFE (HRS)	HOURS		HRS TO		MINOR OVHAUL COST (\$)		MAJOR OVHAUL COST (\$)	
							ALREADY USED		MINOR OVHAUL		MINOR OVHAUL		MAJOR OVHAUL	
HW-BOILER	40.000	300.000	1.400	0.000	8.0	220000.	0.	10000.	2000.	50000.	25000.			

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 67.760 103.486 31/22	NATURAL-GAS 514.419 1174.249 15/ 3
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	60.960 103.486 28/22	404.749 1109.380 3/ 7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	66.101 103.486 31/22	348.447 880.326 3/ 7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	57.574 103.486 16/ 9	146.750 629.963 5/ 7
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	53.240 103.486 9/ 7	44.590 511.693 1/ 6
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.455 79.475 30/22	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	49.845 79.475 31/20	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	50.318 79.475 31/22	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.297 79.475 30/22	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	59.248 103.486 31/22	147.824 728.912 20/ 8
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	62.717 103.486 30/22	298.842 854.375 3/ 4
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	67.474 103.486 31/20	473.741 1037.745 13/ 8
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	691.989 103.486	2379.362 1174.249

HEATING LOADS		PCT OF TOTAL LOAD	
HW-BOILER	MBTU SUPPLIED		
	1648.5	100.0	
LOAD SATISFIED			
TOTAL LOAD ON PLANT	1648.5	100.0	
ELECTRICAL LOADS		PCT OF TOTAL LOAD	
ELECTRICITY	MBTU SUPPLIED		
	692.0	100.0	
LOAD SATISFIED			
TOTAL LOAD ON PLANT	692.0	100.0	

SUMMARY OF LOADS MET

TYPE OF LOAD	TOTAL LOAD (MBTU)	LOAD SATISFIED (MBTU)	TOTAL OVERLOAD (MBTU)	PEAK OVERLOAD (MBTU)	HOURS OVERLOADED
HEATING LOADS	1648.5	1648.5	0.000	0.000	0
ELECTRICAL LOADS	692.0	692.0	0.000	0.000	0

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	86.12	2379.36
SPACE COOL	0.00	0.00
HVAC AUX	436.97	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	168.85	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	691.94	2379.36

TOTAL SITE ENERGY 3071.35 MBTU 465.4 KBTU/SQFT-YR GROSS-AREA 465.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 4457.41 MBTU 675.4 KBTU/SQFT-YR GROSS-AREA 675.4 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.2
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.



D9-69

*** BUILDING ***

FLOOR AREA 6600 SQFT 613 SQMT
VOLUME 211200 CUFT 5981 CUMT

		COOLING LOAD		HEATING LOAD	
TIME		MAY 12 6PM		JAN 4 3AM	
DRY-BULB TEMP	82F	28C		8F -13C	
WET-BULB TEMP	64F	18C		7F -14C	

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	0.954	0.279	0.000	0.000	-9.624	-2.819
ROOFS	12.920	3.784	0.000	0.000	-35.393	-10.366
GLASS CONDUCTION	14.043	4.113	0.000	0.000	-97.286	-28.492
GLASS SOLAR	115.769	33.906	0.000	0.000	3.427	1.004
DOOR	0.021	0.006	0.000	0.000	-0.135	-0.040
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.476	-0.432	0.000	0.000	-1.810	-0.530
OCCUPANTS TO SPACE	12.622	3.697	21.800	6.385	2.410	0.706
LIGHT TO SPACE	26.042	7.627	0.000	0.000	8.390	2.457
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	198.828	58.232	0.000	0.000
INFILTRATION	13.803	4.042	1.190	0.349	-125.891	-36.870
TOTAL	194.696	57.022	221.818	64.965	-255.910	-74.950
TOTAL LOAD	416.514	KBTU/H	121.987	KW	-255.910	KW
TOTAL LOAD / AREA	63.11	BTU/H.SQFT	198.947	W /SQMT	38.774	BTU/H.SQFT W /SQMT

*
* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR
* --- LOADS
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION
* IN CONSIDERATION
*

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 4/1995 10:38:23 EDL RUN 1
DENVER, CO 80227 HEATING SEASON FOR BLDG. #8069-POOL SWIMMING POOL AREA
REPORT- LS-D BUILDING MONTHLY LOADS SUMMARY TOPEKA, KS
HRU simulation

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.24722	18 16	52.F	43.F	28.859	-73.182	4 3	8.F	7.F	-255.910	4199.	9.236
FEB	1.36480	13 16	58.F	48.F	59.207	-49.457	1 23	17.F	15.F	-204.686	3774.	9.236
MAR	9.20274	27 17	69.F	50.F	116.761	-35.871	3 8	15.F	12.F	-205.419	4239.	9.236
APR	30.67085	25 15	83.F	66.F	176.314	-10.922	4 4	33.F	31.F	-127.729	4088.	9.236
MAY	22.36159	12 17	82.F	64.F	194.696	-2.054	5 5	44.F	40.F	-81.912	2021.	9.236
JUN	0.00000				0.000	0.000				0.000	0.	0.000
JUL	0.00000				0.000	0.000				0.000	0.	0.000
AUG	0.00000				0.000	0.000				0.000	0.	0.000
SEP	0.00000				0.000	0.000				0.000	0.	0.000
OCT	23.55433	1 16	85.F	68.F	159.061	-12.471	20 7	23.F	22.F	-117.428	4153.	9.236
NOV	6.46319	7 15	73.F	58.F	92.995	-31.216	30 5	29.F	26.F	-150.566	4093.	9.236
DEC	0.33447	21 15	55.F	44.F	26.488	-67.893	15 5	8.F	7.F	-211.993	4147.	9.236
TOTAL	94.199					-283.065					30714.	
MAX					194.696					-255.910		9.236

D9-71

MESSAGE LIST FROM SYSTEMS PROGRAM

WARNING**
 SYSTEM POOL-H&V'S MAY HAVE INADEQUATE HEATING CAPABILITY
 (CHECK HEATING-CAPACITY, HEAT-SET-T, PRE-HEAT-T AND MAX-SUPPLY-T FOR CONSISTENCY)

[illegible]

EMC	ENGINEERS	INC.	EZDOE - ELITE SOFTWARE DEVELOPMENT INC	DOE-2.1D	3/ 4/1995	10:38:23	SDL RUN 1
DENVER,	CO	80227	HEATING SEASON FOR BLDG. #8069-POOL	SWIMMING POOL AREA			
REPORT- SV-A	SYSTEM DESIGN PARAMETERS		POOL-H&V'S	TOPEKA, KS			

[illegible]

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 4/1995 10:38:23 SDL RUN 1
DENVER, CO 80227 HEATING SEASON FOR BLDG. #8069-POOL SWIMMING POOL AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR HRU ~~POOL H&V'S~~ TOPEKA, KS

MONTH	C O O L I N G				H E A T I N G				E L E C			
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)	
JAN	0.00000				-127.793	15	-8.F	-9.F	-349.141	14645.	23.276	
FEB	0.00000				-89.817	3	-5.F	-6.F	-312.897	13209.	23.276	
MAR	0.00000				-63.658	3	15.F	12.F	-266.065	14685.	23.276	
APR	0.00000				-16.159	5	31.F	29.F	-143.816	14197.	23.276	
MAY	0.00000				-2.578	5	44.F	40.F	-88.837	7075.	23.276	
OCT	0.00000				-16.335	20	23.F	22.F	-177.703	14598.	23.276	
NOV	0.00000				-55.277	2	16.F	15.F	-227.738	14202.	23.276	
DEC	0.00000				-114.275	12	4.F	3.F	-302.674	14593.	23.276	
TOTAL	0.000				-485.892				-349.141	107200.	23.276	
MAX												

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 4/1995 10:38:23 SDL RUN 1
DENVER, CO 80227 HEATING SEASON FOR BLDG. #8069-POOL SWIMMING POOL AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR POOL-H&V'S TOPEKA, KS

MONTH	HOURS COOLING LOAD		HOURS COINCIDENT COOL-HEAT LOAD		N U M B E R O F		H O U R S		HOURS FANS ON CYCLE ON		HOURS NIGHT VENTING		HOURS FLOATING WHEN FANS ON		--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)		ELECTRIC LOAD AT COOLING PEAK (KW)	
JAN	0	744	0	0	744	0	0	744	0	0	0	0	0	0	-132.150	14.040		
FEB	0	661	0	11	672	0	0	672	0	0	0	0	11	11	-129.584	14.040		
MAR	0	637	0	107	744	0	0	744	0	0	0	0	107	107	-124.141	14.040		
APR	0	309	0	411	720	0	0	720	0	0	0	0	411	411	-13.589	14.040		
MAY	0	82	0	278	360	0	0	360	0	0	0	0	278	278	0.000	14.040		
OCT	0	360	0	384	720	0	0	744	0	0	0	0	384	384	-92.625	14.040		
NOV	0	599	0	121	720	0	0	720	0	0	0	0	121	121	-174.112	14.040		
DEC	0	744	0	0	744	0	0	744	0	0	0	0	0	0	-172.503	14.040		
ANNUAL	0	4136	0	1312	5424	0	0	5448	0	0	0	0	1312	1312				

[illegible]

E Q U I P M E N T	NUMBER		NUMBER		NUMBER		NUMBER	
	SIZE (MBTU/H)	INSTD	SIZE (MBTU/H)	AVAIL	SIZE (MBTU/H)	INSTD	SIZE (MBTU/H)	AVAIL
HW-BOILER	0.352	1	1					

[illegible]

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 4/1995 10:38:23 PDL RUN 1
 DENVER, CO 80227 HEATING SEASON FOR BLDG. #8069-POOL SWIMMING POOL AREA
 REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE *HRU Simulation* TOPEKA, KS

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 56.458 88.459 31/22	NATURAL-GAS 179.603 439.382 15/ 3
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	50.736 88.459 28/22	132.244 401.044 3/ 7
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	54.838 88.459 31/22	96.826 350.408 3/ 8
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	50.171 88.459 15/ 8	26.704 212.395 5/ 5
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	24.504 85.768 9/ 6	4.527 147.578 5/ 6
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	51.705 88.459 31/ 9	27.557 251.497 20/ 8
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	52.812 88.459 30/22	85.255 308.047 2/ 5
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	56.181 88.459 31/20	163.947 390.097 12/ 5
DEC	ONE YEAR USE/PEAK	397.406 88.459	716.664 439.382

D9-75

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 4/1995 10:38:23 PDL RUN 1
 DENVER, CO 80227 HEATING SEASON FOR BLDG. #8069-POOL SWIMMING POOL AREA
 REPORT- PS-D PLANT LOADS SATISFIED TOPEKA, KS

HEATING LOADS	MBTU SUPPLIED	PCT OF TOTAL LOAD
HW-BOILER	495.7	100.0
LOAD SATISFIED	495.7	100.0
TOTAL LOAD ON PLANT	495.7	
ELECTRICAL LOADS	MBTU SUPPLIED	PCT OF TOTAL LOAD
ELECTRICITY	397.4	100.0
LOAD SATISFIED	397.4	100.0
TOTAL LOAD ON PLANT	397.4	

HRU simulation

SUMMARY OF LOADS MET

TYPE OF LOAD	TOTAL LOAD (MBTU)	LOAD SATISFIED (MBTU)	TOTAL OVERLOAD (MBTU)	PEAK OVERLOAD (MBTU)	HOURS OVERLOADED
HEATING LOADS	495.7	495.7	0.000	0.000	0
ELECTRICAL LOADS	397.4	397.4	0.000	0.000	0

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	26.19	716.66
SPACE COOL	0.00	0.00
HVAC AUX	266.34	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	104.87	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	397.40	716.66

TOTAL SITE ENERGY 1114.07 MBTU 168.8 KBTU/SQFT-YR GROSS-AREA 168.8 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1910.08 MBTU 289.4 KBTU/SQFT-YR GROSS-AREA 289.4 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.1
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

Des Champs Laboratories Incorporated (DLI)

continuing commitment

Since 1974, Des Champs Laboratories Incorporated (DLI) has been a dominant leader in the design and manufacture of plate type air-to-air heat exchangers and packaged recovery systems. DLI has maintained that position through proven reliability with over 10,000 successful installations in every industry, from residential to commercial and including process applications. Our valued reputation for innovative engineering and quality control assures you of a superior heat recovery package capable of meeting the most demanding applications.

In addition to our in-house applications engineers, DLI is complemented by a full field service organization, as well as 50 manufacturer representative organizations; experts themselves in the energy recovery market.

Energy recovery is our business...our only business.

ZPACK Packaged Energy Recovery System

The Z-PACK System is engineered to accommodate a wide range of industrial and HVAC energy recovery applications. The complete integration of a Z-DUCT heat exchanger, fans, and controls provide pre-engineered systems, efficient space utilization, reduce overall costs and maximize energy recovery.

ZPACK Systems provide advantages such as:

- ETL Listed
- Single source responsibility
- Complete factory testing prior to shipment
- Reduction of overall installed costs
- Efficient space utilization by pre-design
- Years of experience in designing complete systems with energy recovery
- Computerized design to solve energy recovery problems
- Wide range of models
- Host of options



Industrial and commercial heat exchangers and packaged systems are manufactured at the 44,000 square foot facility in East Hanover, NJ. Also located here are the Administration, Engineering, Sales, Service, and Purchasing Departments.



Manufacture of the high temperature heat exchanger matrix, using state-of-the art machinery developed by Des Champs Laboratories, takes place in the Livingston, NJ facility. Also located here is the Residential heat exchanger department, the expanded Research & Development Department, Marketing, Full Service Advertising/Graphics Department, and Accounting.

ZPACK® for total environmental control

ZPACK features the unique Z-DUCT® heat exchanger

Z-DUCT is a plate type air-to-air heat exchanger. Its purpose is to transfer the thermal energy in the hot exhaust airstreams to the incoming fresh airstreams.

Counterflow airstreams are brought into close proximity, separated by one continuous, dimpled and folded, sheet of aluminum which acts as a primary heat transfer surface. This heat transfer surface is configured to form a matrix with two completely separate and distinct air passages, virtually eliminating cross-contamination. This transfer of energy from exhaust to intake air can result in a substantial energy savings.

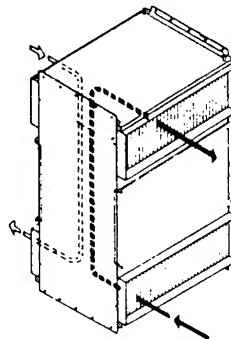
Z-DUCT heat exchangers are highly efficient and have an effectiveness of 65-85%.

ZPACK offers maximum year-round energy savings

There are three modes of energy recovery that Z-DUCT can provide:

1. In winter, Z-PACK energy recovery systems recover thermal energy, previously exhausted to atmosphere, to preheat fresh incoming ventilation or make-up air.
2. In summer, an indirect evaporative cooling process transfers sensible and latent energy from the hot fresh air to the cool exhaust air, thereby cooling the fresh air.
3. In process-to-process applications, the energy from process exhaust can be used to preheat process air on a year-round basis.

Air-to-Air Heat Recovery Modules to Complete Engineered Packages



ZDUCT®

*Customized
Specialization*

ZPACK is compact and reliable

The unique Z-DUCT heat exchanger, supply and exhaust fans, and all related controls are built into a single package for indoor or outdoor mounting. The sheet metal housing is a panellized design that provides separate air plenums for intake and exhaust air. It is coated with a corrosion resistant paint, insulated and weatherproofed. All joints are sealed and/or capped to prevent leakage. The fully hinged doors provide access for the inspection and maintenance of all serviceable components.

ZPACK is designed to accommodate optional equipment

Z-PACK offers the options necessary to meet the needs of most energy recovery and make-up air applications. Design flexibility assures effective energy recovery system performance on every application.

ZPACK provides substantial benefits to the user

Most applications have a 1 to 3 year payback period. In addition to conserving valuable energy and saving dollars, productivity can also be increased in specific applications.

PKS Series

Applications

The PKS Series is recommended when high temperature exhausts or dirty airstreams are present. The PKS Series houses a Series 75 heat exchanger. It is equipped with a single width, single inlet exhaust fan that provides safe operation with hot or fume laden air. One of the standard design features includes an inlet plenum which was designed to satisfy the intent of NFPA96. Also, an optional safeguard against overheating has been designed for this system. (Refer to Page 17, Code 730 for complete information on design option). Some typical applications include:

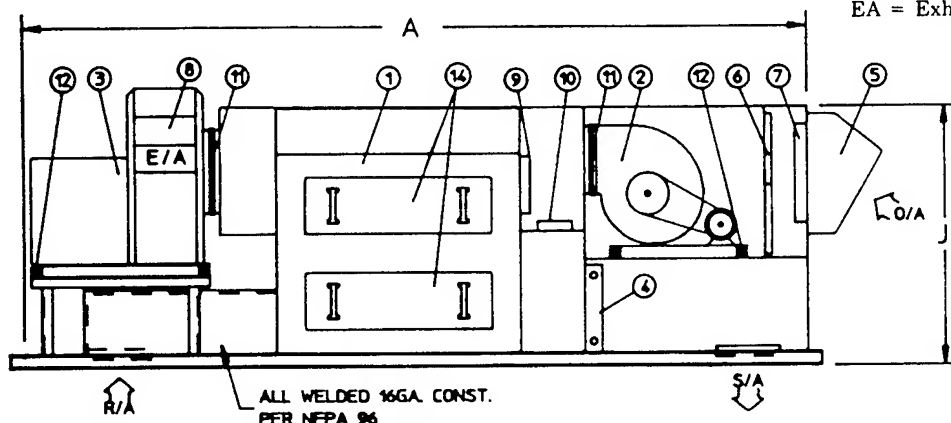
- fast food fryers
- chemical fumes
- sewerage treatment plants
- drying or curing ovens
- laboratory hoods
- process exhausts

•PKS 2 and 3 available-consult factory

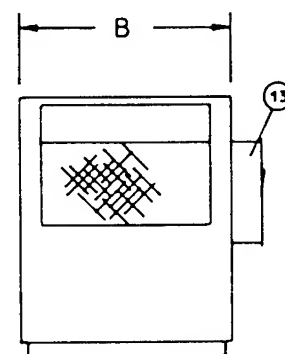
PKS SERIES 4 - 6 - 8 - 10

Legend

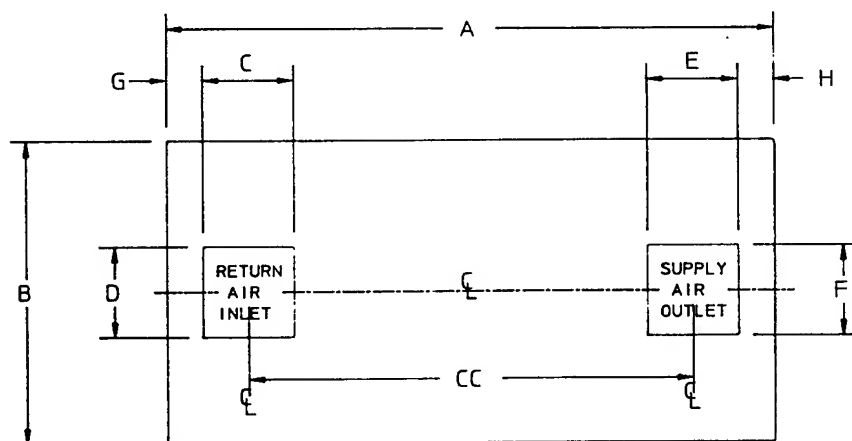
1. Z-DUCT Series 75 Heat Exchanger
 2. Supply Fan W/Motor & Drives
 3. Exhaust Fan W/Motor & Drives
 - *4. Heating and/or Cooling Coil (Optional)
 5. O/A Hood W/Bird Screen
 6. Supply Filters
 7. O/A Damper (Optional)
 8. E/A B/D Gravity Damper (Optional)
 9. O/A Face Damper (Optional)
 10. O/A Bypass Damper (Optional)
 11. Flex Duct Connection
 12. Spring Type Isolators
 13. Combination Disconnect & Control Panel
 14. Heat Exchanger Access Doors
 15. E/A Control Damper (Optional)
 16. Recirculation Damper (Optional)
- *For cooling coils in PKS Series-consult factory



SIDE ELEVATION



END VIEW



BOTTOM DUCT CONNECTION DETAIL

MODEL	DIMENSIONS (in inches)										SUPPLY FAN	EXHAUST FAN	WEIGHT	NOMINAL RATING
NO.	A	B	C	D	E	F	G	H	J	CC	SIZE (BI) DWDI	SIZE (BI) SWSI	LBS.	SCFM
PKS4	172 1/4	60	18	24	18	24	16	6	73 1/4	132 1/4	15	20	3,630	4,000
PKS6	221 3/4	60	18	36	18	36	18	8	73 1/4	177 3/4	18	22	4,400	6,000
PKS8	252 3/4	60	24	36	24	36	20	8	95	200 3/4	20	27	5,225	8,000
PKS10	299	72	24	48	24	48	20	8	100	247	22	30	6,050	10,000

Refer to page 11 for important notes concerning the above table.



LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: **BLDG 8069 - Replace H&V Units with Pool Dehumidification / Pool Heating Unit**

A. CONSTRUCTION COST	=	\$181,320
B. SIOH COST	(5.5% of 1A) =	\$9,973
C. DESIGN COST	(6.0% of 1A) =	\$10,879
D. TOTAL COST	(1A + 1B + 1C) =	\$202,172
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$202,172

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

	ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
					<u>JAN '95</u>	
A.	ELECT.	\$12.10	(559)	(\$6,769)	15.88	(\$107,488)
B.	DIST	\$0.00	0	\$0	19.16	\$0
C.	NAT GAS	\$4.12	3,223	\$13,277	18.30	\$242,964
D.	COAL	\$0.00	0	\$0	16.62	\$0
E.	ELEC. DEMAND			\$0	14.88	\$0
F.	TOTAL		2,663	\$6,508		-----> \$135,476

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	\$0	14.88	\$0
2		\$0	14.88	\$0
3		\$0	14.88	\$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
			(TABLE A-2)	
a. BASELINE EQUIP. REPLCMNT.	\$35,706	5	0.863	\$30,814
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$35,706			\$30,814

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$30,814

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$8,293
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	24.38
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$166,290
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	0.82
(MUST HAVE SIR > 1.25 TO QUALIFY)		

ENGINEER'S OPINION OF PROBABLE COST										
PROJECT			Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER			E M C Engineers, Inc. Denver, CO							
SHEET			1		OF		1			
DATE PREPARED			4-May-95							
ESTIMATOR			C. Wohler							
CHECKED BY			A. Niemeyer							
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST				TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 8069								
2		PROPOSED SYSTEM MODIFICATIONS								
3										
4		NEW SYSTEMS INSTALLATION								
5		Martini 2012								
6	STLPIP4	STEEL PIPE SCH. 40, 4" W/HANGERS	EA.	2.0	\$49,600.00	\$99,200	Q-6	40	\$1,608	\$100,808
7	INSLPIP4	FITTINGS, 5%	L.F.	200.0	\$9.16	\$1,831	Q-15	0.432	\$1,675	\$3,507
8	STLPIP3	4" FIBERGLASS PIPE INSULATION, 1.5" THCK				\$92			\$84	\$175
9	INSLPIP3	STEEL PIPE SCH. 40, 3" WHANGERS	L.F.	200.0	\$1.89	\$378	Q-14	0.114	\$420	\$798
10	PMP5HP	FITTINGS, 5%	L.F.	100.0	\$6.40	\$640	Q-15	0.372	\$721	\$1,361
11	DUCT500	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	100.0	\$32	\$32			\$36	\$68
12	ELCND1	PUMP, 5 HP	EA	2.0	\$1.66	\$166	Q-14	0.094	\$173	\$339
13	WIRE#6	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	1260.0	\$1,114.35	\$2,229	Q-1	8.889	\$345	\$2,573
14	ROFEXH15	ELECTRICAL CONDUIT 1"	L.F.	50.0	\$0.47	\$586	Q-10	0.098	\$2,399	\$2,985
15	E-TSTAT1	COPPER WIRING #6	C.L.F.	1.0	\$0.83	\$42	1-ELEC	0.064	\$67	\$109
16	WIRE#12	ALUMINUM GALV. ROOF INTAKE, 15,000 CFM	EA.	1.0	\$24.71	\$25	1-ELEC	1.231	\$26	\$50
17		SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	\$24.16	\$24	Q-9	12.3	\$231	\$2,847
18		COPPER WIRING #12	C.L.F.	1.0	\$24.23	\$24	1-ELEC	0.8	\$17	\$41
19		ROOF PENETRATION	EA.	2.0	\$7.41	\$7	1-ELEC	0.727	\$15	\$23
20							Q-5	14	\$543	\$543
21										
22										
23										
24										
25		EXISTING SYSTEMS DEMOLITION								
26		AHU DEMO	TON	4.0			Q-5	17.778	\$1,379	\$1,379
#REF!										
#REF!										
#REF!		SUBTOTAL				\$107,867			\$9,739	\$117,606
#REF!	OH	OVERHEAD			17%	\$18,122			\$1,636	\$19,758
#REF!	PRO	PROFIT			10%	\$12,599			\$1,137	\$13,736
#REF!	CONT	CONTINGENCY			20%	\$27,718			\$2,502	\$30,220
#REF!	TOTAL COST			-	-	\$166,305			\$15,015	\$181,320

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT				Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1	
ENGINEER				E M C Engineers, Inc. Denver, CO				DATE PREPARED 4-May-95	
								ESTIMATOR C. Wohler	
								CHECKED BY A. Niemeyer	
Line No	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 8069							
2		NON-RECURRING							
3									
4		EXISTING SYSTEM REPLACEMENT							
5	AHU5400	5,400 CFM AHU, HEATING ONLY	EA.	4.0	\$3,803.33	\$15,213	Q-6	30	\$2,413
6	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	500.0	\$0.47	\$233	Q-10	0.098	\$952
7	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	120.0	\$2.56	\$307	Q-1	0.2	\$465
8		FITTINGS ADD 5%				\$15			\$23
9	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	\$1.40	\$167	Q-14	0.08	\$177
10	CNTV1	CONTROL VALVE 1"	EA.	4.0	\$190.89	\$764	1-PLUM	0.471	\$41
11	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT. 3 WIRE	EA.	1.0	\$24.23	\$24	1-ELEC	0.8	\$17
12	WIRE#12	COPPER WIRING #12	C.L.F.	1.0	\$7.41	\$7	1-ELEC	0.727	\$15
13	DMP28X44	DAMPER W/ ACT, 28" X 44"	EA.	3.0	\$278.10	\$834	Q-9	2	\$112
14									
15									
16									
17									
18									
19									
20									
21									
22		EXISTING SYSTEMS DEMOLITION							
23		AHU DEMO	TON	4.0			Q-5	17.778	\$1,379
24									
25									
26									
27									
28									
29									
30									
31		SUBTOTAL				\$17,565			\$5,594
32	OH	OVERHEAD			17%	\$2,951			\$940
33	PRO	PROFIT			10%	\$2,052			\$653
34	CONT	CONTINGENCY			20%	\$4,514			\$1,437
35	TOTAL COST		-	-	-	\$27,081	-	-	\$8,625
									\$23,159
									\$3,891
									\$2,705
									\$5,951
									\$35,706

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF 1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-Mar-95	
						ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		Crew/Worker	Hours/Unit	Total	TOTAL
1		BUILDING 8069		Quantity	Unit Cost				
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE						\$0	\$0
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE						\$0	\$0
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS						\$0	\$0

MARTINI-2000 FRESH AIR INDOOR POOL DEHUMIDIFICATION

by
Des Champs Laboratories Incorporated
Box 440, East Hanover, New Jersey 07936
201-884-1460 FAX 201-884-8960

GENERAL INFORMATION

DATE ANALYSIS WAS PERFORMED:..... 02-22-1995
JOB NAME:..... HVAC UPGRADE
JOB NUMBER:..... 1406-005
DLI REPRESENTATIVE:..... EMC ENGINEERS
ENGINEER OR ARCHITECT:..... A. J. NIEMEYER
ANALYSIS PREPARED BY:..... A. J. NIEMEYER
ACTUAL SITE LOCATION:..... FT. RILEY, KS
NEAREST SITE HAVING AVAILABLE BIN DATA:..... Topeka KA
FILE NAME (STORED AS DOS FILE):..... BLDG8069

INFORMATION REQUIRED TO PROPERLY SELECT MARTINI-2000

SUMMER A/C CONTROL? (Y/N):..... Y
SUMMER SENSIBLE LOAD, BTU/hr:..... 840000
(Does Not Include Outside Air)
OPTIONAL INTEGRAL POOL WATER HEATER? (Y/N):..... Y
SYSTEM VOLTAGE? (120/208/460):..... 460
INSTALL OUTDOORS? (Y/N):..... N
CURB OR SLAB? (C/S):.....
SUSPEND CEILING OR FLOOR MOUNT? (S/M):..... M

DESIGN RELATIVE HUMIDITY, Percent:..... 50-60
AIR TEMPERATURE, Degrees F:..... 78
POOL #1 WATER TEMPERATURE, Degrees F:..... 84
POOL #1 WATER AREA, Square Feet:..... 3444
POOL #2 WATER TEMPERATURE, Degrees F:..... 0
POOL #2 WATER AREA, Square Feet:..... 0
DECK AREA(without pool), Square Feet:..... 2736
ACTIVE HOURS PER DAY, Hours:..... 15
POOL ACTIVITY FACTOR(Private=1, Public=2):..... 2
AVERAGE CEILING HEIGHT OF SPACE, Feet:..... 24
NOTES:..... BLDG 8069

INFORMATION REQUIRED TO DETERMINE OPERATING COST

ELECTRICITY = E STEAM = S OIL = O GAS = G
POOL HEATED WITH? (E/S/O/G):..... S
OUTSIDE AIR HEATED WITH? (E/S/O/G):..... S
ELECTRICITY COST, \$/KwHr:..... .0413
STEAM COST, \$/1000 Pounds:..... 4.33
OIL COST, \$/Gallon:..... 0
GAS COST, \$/Therm (1 Therm = 100,000 BTU):..... 0

LOCAL DESIGN CONDITIONS

ALTITUDE, Feet:..... 877
HEATING HOURS, Hours:..... 6384
COOLING HOURS, Hours:..... 2376
WINTER DESIGN TEMPERATURE, Degrees F:..... -4
SUMMER DESIGN DRY BULB TEMPERATURE, Degrees F:..... 99
SUMMER DESIGN WET BULB TEMPERATURE, Degrees F:..... 79

MARTINI-2000 FRESH AIR INDOOR POOL DEHUMIDIFICATION
by
Des Champs Laboratories Incorporated
File Name: BLDG8069 Job Name: HVAC UPGRADE

THERMODYNAMIC CONDITIONS WITHIN POOL ENCLOSURE

INACTIVE PERIOD POOL EVAPORATION:

Pool No.1 Water Evaporation Rate, Lbs/hr:.....	100.60
Pool No.2 Water Evaporation Rate, Lbs/hr:.....	0.00
Total Hourly Evaporation Rate, Lbs/hr:.....	100.60
Inactive Hours Daily:.....	9.00
Inactive Daily Evaporation Rate, Lbs/day:.....	905.39

ACTIVE PERIOD POOL EVAPORATION USING 2 ACTIVITY FACTOR:

Pool No.1 Water Evaporation Rate, Lbs/hr:.....	201.20
Pool No.2 Water Evaporation Rate, Lbs/hr:.....	0.00
Total Hourly Evaporation Rate, Lbs/hr:.....	201.20
Hours Daily:.....	15.00
Active Daily Evaporation Rate, Lbs/day:.....	3,017.96

TOTAL OF ACTIVE AND INACTIVE DAILY PERIODS:

Total Daily Evaporation Rate, Lbs/day:.....	3,923.35
Average Hourly Evaporation Rate, Lbs/hr:.....	163.47
Total Make-Up Water Required, Gallons/day:.....	470.43

AIR FLOW, CFM, DELIVERED TO THE POOL ENCLOSURE FOR:

4 Air Changes/hr(Winter Design>10F with No Spectators):	9,888.00
6 Air Changes/hr(Most Climates with Some Spectators):...	14,832.00
8 Air Changes/hr(Winter Design<10F with Spectators):...	19,776.00
ASHRAE Recommended Minimum Outside Air(0.5 CFM/SqFt):...	3,090.00

CALCULATED TEMPERATURE CONDITIONS WITHIN POOL ENCLOSURE:

Pool Air Dew Point Temperature at 60 % R.H, Degrees F: 63.05

Approximate Inside Wall Temperature on Design Winter Day, F

Inside Film Coefficient BTU/(hr SqFt F)	Thermal Resistance, R, (hr SqFt F)/BTU				
	2	3	15	20	25
0.90 (still air)	<u>32.44</u>	<u>47.63</u>	71.93	73.44	74.36
1.50 (150 ft/min)	<u>50.67</u>	<u>59.78</u>	74.36	75.27	75.81
3.00 (500 ft/min)	<u>64.33</u>	68.89	76.18	76.63	76.91

In the above table, the 'R' value of 2 is representative of double glazed windows and the value of 3 is representative of triple glazed. The temperatures shown underlined are below or very near the indoor dewpoint temperature, therefore condensing may occur.

MARTINI-2000 FRESH AIR INDOOR POOL DEHUMIDIFICATION
 by
 Des Champs Laboratories Incorporated
 File Name: BLDG8069 Job Name: HVAC UPGRADE

COST TO DEHUMIDIFY, CONDITION INCOMING FRESH AIR, AND HEAT POOL WATER

Outside AirTemp,F	Hours @ Temp	CFM O.A.	Cost, \$/Hour, to:			Total BIN Cost
			Condition Air	Heat Pool	Overcome HX Press.	
Operation During Heating Season						
-3	23	4485	0.610	1.029	0.022	38.19
2	44	4590	0.586	1.029	0.023	72.06
7	87	4588	0.547	1.029	0.023	139.11
12	141	4748	0.527	1.029	0.026	222.89
17	209	4961	0.508	1.029	0.029	327.34
22	314	5049	0.475	1.029	0.031	481.83
27	432	5397	0.462	1.029	0.038	660.37
32	615	5204	0.402	0.957	0.034	856.43
37	613	5779	0.398	0.957	0.046	858.75
42	586	6229	0.377	0.957	0.058	815.23
47	533	6880	0.358	0.957	0.078	742.39
52	601	7869	0.344	0.957	0.116	851.51
57	633	10823	0.382	0.957	0.303	1038.97
Cost to Operate During Heating Season:..... \$						7,105.08

Operation During Cooling Season						
62	709	3090	0.433	0.000	0.239	476.36
67	805	3090	0.522	0.000	0.239	612.58
72	805	3090	0.594	0.000	0.239	670.63
77	657	3090	0.643	0.000	0.239	579.08
82	469	3090	0.677	0.000	0.239	429.35
87	269	3090	0.756	0.000	0.239	267.58
92	139	3090	0.802	0.000	0.239	144.68
97	38	3090	0.810	0.000	0.239	39.85
102	7	3090	0.819	0.000	0.239	7.40
Cost to Operate During Cooling Season:.....						\$ 3,227.52

Yearly Cost to Condition Air and Heat Pool Water:.....\$ 10,332.60

$\$10,332.6 \times \frac{1 \text{ kWh}}{\$0.0413} = 250,184 \text{ kWh}; 250,184 \text{ kWh} \times 3413 \frac{\text{Btu}}{\text{kWh}} = 853,878,058 \text{ Btu or } 853.9 \text{ MBtu}$

MARTINI-2000 MODEL SELECTION FOR THIS APPLICATION IS:

Model Required for Dehumidification --> 2020-ODAC-2190

The MARTINI 2020-ODAC-2190 Will Result in 8.09 Air Changes per Hour.

Model Required for: 4 Air Changes per Hour --> 2012-ODAC-1352

6 Air Changes per Hour --> 2016-ODAC-1752

8 Air Changes per Hour --> 2020-ODAC-2190

If the Model selected to give the proper dehumidification does not result in the proper air changes then please contact the factory to discuss the proper selection.



Pool Dehumidification and Water Heating with Energy Recycling

The Martini 2000, by Des Champs Laboratories, is an all season pool dehumidification unit, utilizing energy recycling to heat pool water and air at high efficiency and low operating cost. It is lower in operating cost than competitive units because only outdoor air is used to dehumidify for most of the year. No compressor is required to operate during this period.

The Martini 2000 automatically changes its operating mode as climatic conditions change with the seasons, to provide dehumidification of the pool area, utilizing the most economical operating mode for the conditions. The energy recovered in the dehumidification process is recycled to heat the pool water and heat or cool the air being supplied to the pool area. When the outside air dewpoint goes below 55°F, the Martini 2000 shuts off the mechanical dehumidification and increases the outside air for dehumidification, thereby reducing operating costs. All units incorporate the Des Champs energy recycling heat exchanger in all modes of operation to reduce operating costs. Fresh air for ventilation is introduced to the pool space in all modes of operation. Fresh air increases the life of everything in the space... including the humans.

Features and Benefits

- **Fully automatic, all season operation**
No selection switches to manually change from season to season.
- **High efficiency**
Recycles energy in all modes of operation to lower operating costs.
- **Dual level humidity control, automatically**
In winter, the pool space humidity is controlled at a lower humidity than in summer operation. This insures elimination of condensation on cold walls, windows and structure, eliminates building deterioration, and reduces building maintenance.
- **Weatherproof and corrosion resistant construction**
Can be installed indoors or outside on slabs or rooftops. Components and cabinet materials are corrosion resistant.
- **Provides optional pool water heating and supply air heating**
Accomplished with recycled energy, when operating in the mechanical refrigeration mode, reducing operating costs.
- **Maintains negative pressure in the pool space at all times**
Prevents pool moisture from migrating to other rooms.
- **Effective ventilation of pool space in all modes**
Reduces chloramine odors and produces comfortable and safer conditions.
- **Nine unit sizes**
Provide maximum flexibility to select the correct size for the application.
- **Air conditioning option available**
- **Domestic water heating option available**
- **Computer selection and economic analysis by DLI**
Correctly selects unit size and indicates all performance.
- **Spring vibration isolated supply and return fans**
- **Disconnect switch**
- **Integral lifting lugs**

Martini 2000 Performance (Figure 3)

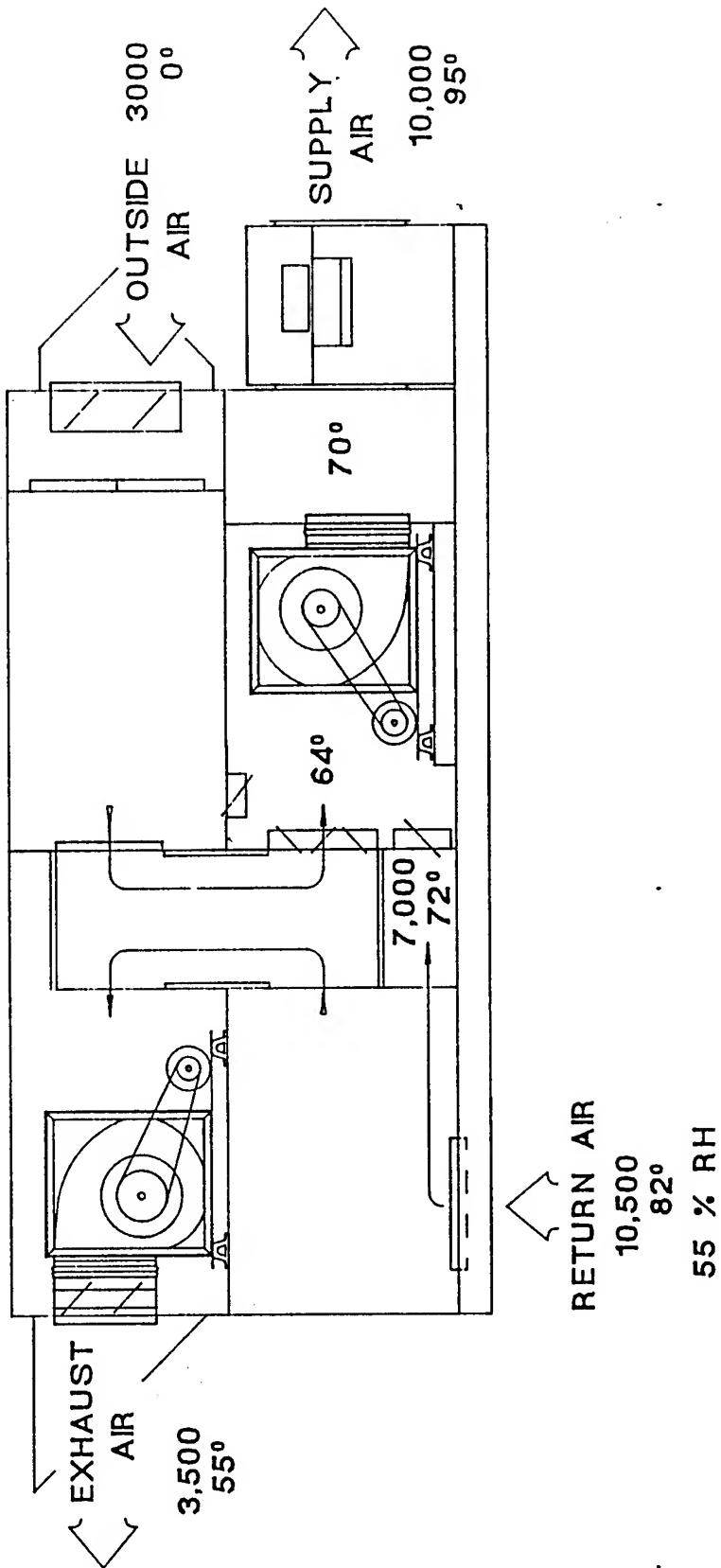
Martini Model	2001	2002	2003	2004	2006	2008	2012	2016	2024
Moisture Absorption Rate (Nominal) lbs./hr.	10	23	36	49	66	97	135	175	241
Supply Air SCFM	1000	2000	3000	4000	6000	8000	12000	16000	22000
Return Air SCFM	1100	2200	3300	4400	6600	8800	13200	17600	24200
Minimum Fresh Air SCFM	250	500	750	1000	1500	2000	3000	4000	5500
Condensing Unit Size (Nominal) Tons ¹	2	4	6	8	10	15	21	26	40
Capacity - BTU/hr.	15000	34500	54000	73500	99000	145500	202500	262500	362000
Water Flow - GPM	3	7	11	15	20	29	40	58	87
Pressure Drop - PSI	4.0	4.5	4.6	8.0	5.5	9.2	5.5	9.2	9.2
Connection Size - Inch	5/8	3/4	1 1/8	1 1/8	1 1/8	1 1/8	1 5/8	1 5/8	1 5/8
Capacity - BTU/hr.	17000	29500	42000	54500	61000	94500	133500	153500	278000
Air Pressure Drop - In. WC	0.22	0.27	0.27	0.31	0.29	0.28	0.27	0.30	0.30
Capacity - BTU/hr.	43400	86800	130200	173600	260400	347200	520800	694400	954800
Air Pressure Drop - In. WC	0.17	0.23	0.26	0.26	0.24	0.21	0.21	0.23	0.23
Water Flow - GPM	4.4	8.7	13.1	17.5	26.2	35.0	52.5	70.0	96.2
Water Pressure Drop - In. WC	3.5	.3	.6	1.2	2.1	3.4	5.8	10.8	10.3
30°F Rise BTU/hr.	N/A	55299	97650	110599	195300	221198	385000	462000	616000
Air Pressure Drop - In. WC	---	0.11	0.49	0.45	0.38	0.47	0.38	0.47	0.68
40°F Rise - BTU/hr.	43400	86800	130200	173600	260400	347200	520800	539000	N/A
Air Pressure Drop - In. WC	0.10	0.24	0.26	0.29	0.26	0.29	0.26	0.36	---

¹ At 80°F, 60% RH pool space conditions and 95°/75° outdoor air temperature.



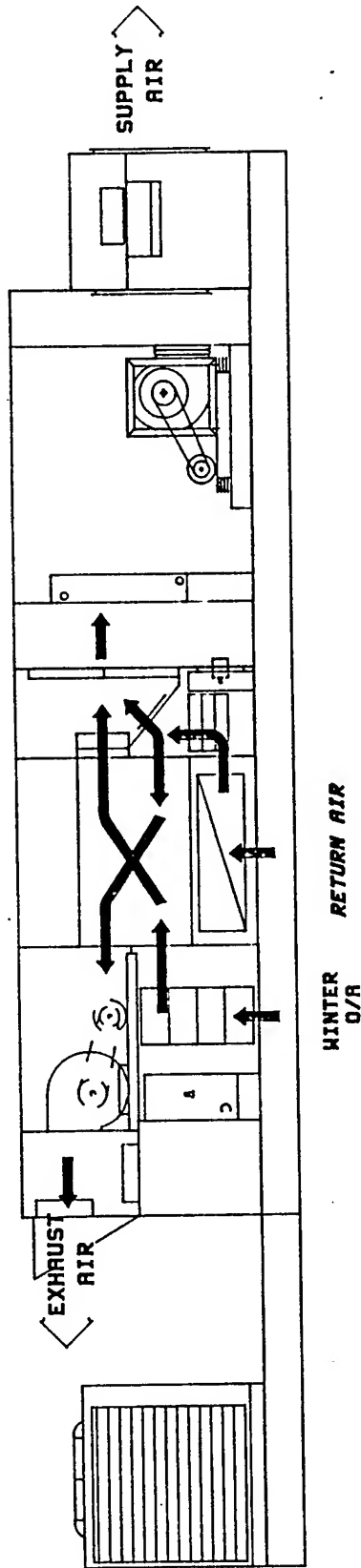
APPENDIX E

MINI Z PACK WITH 30% OUTSIDE AIR & ENERGY RECOVERY FOR TOTAL POOL VENTILATION AND DEHUMIDIFICATION



APPENDIX G

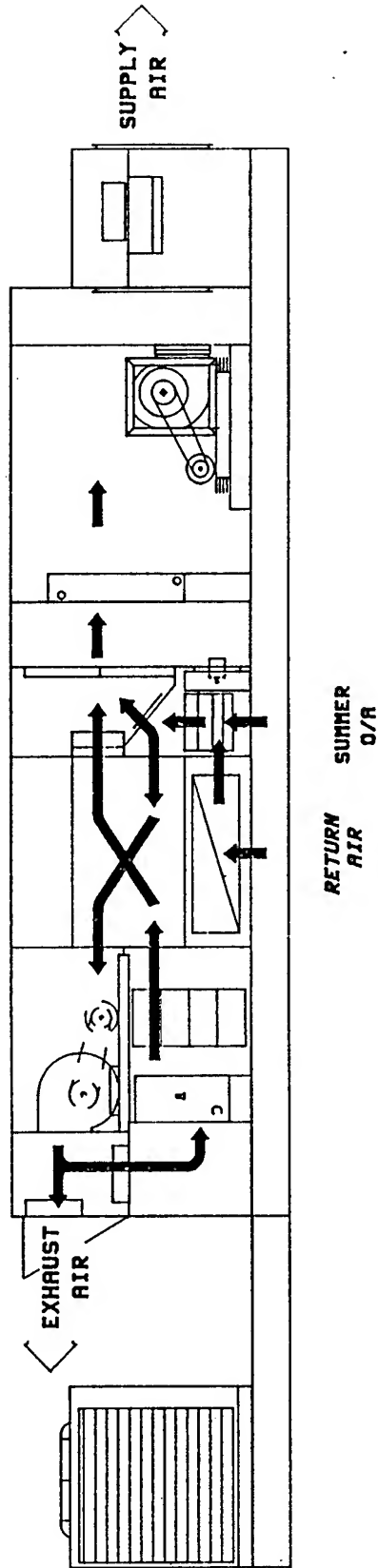
MARTINI 2000



WINTER OPERATION

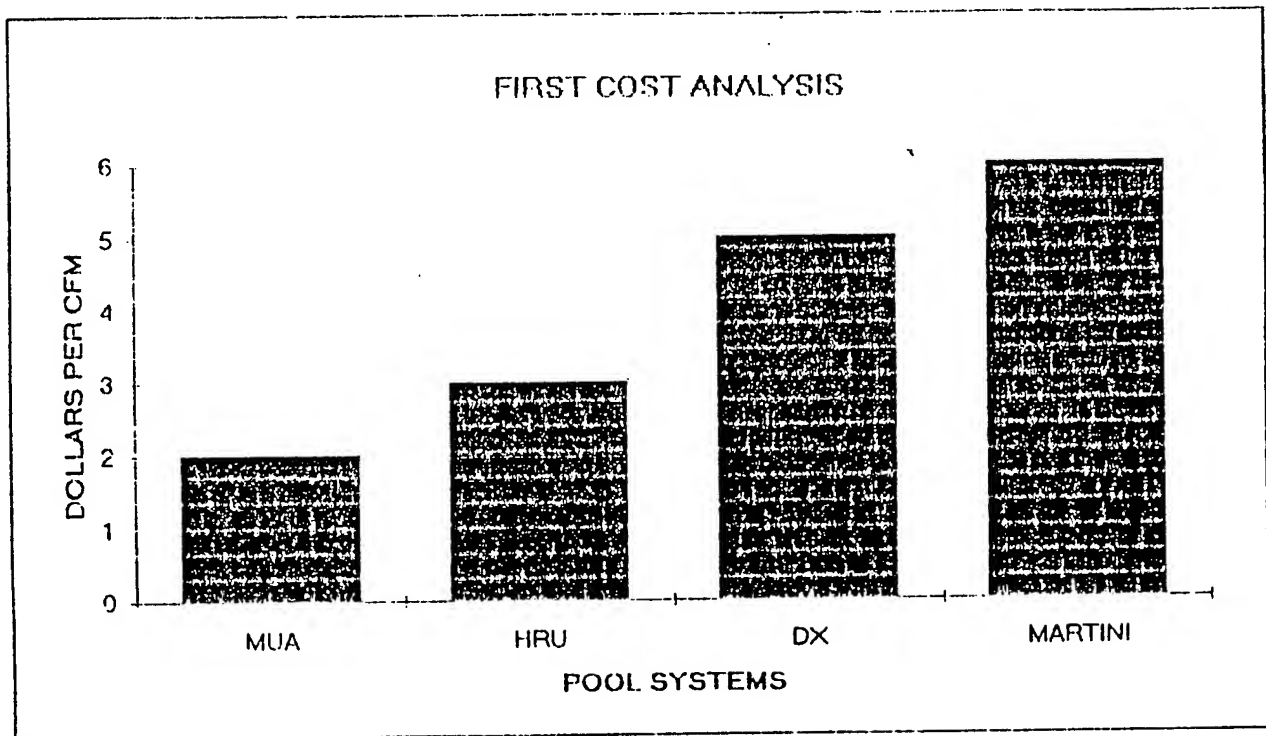
APPENDIX G

MARTINI 2000

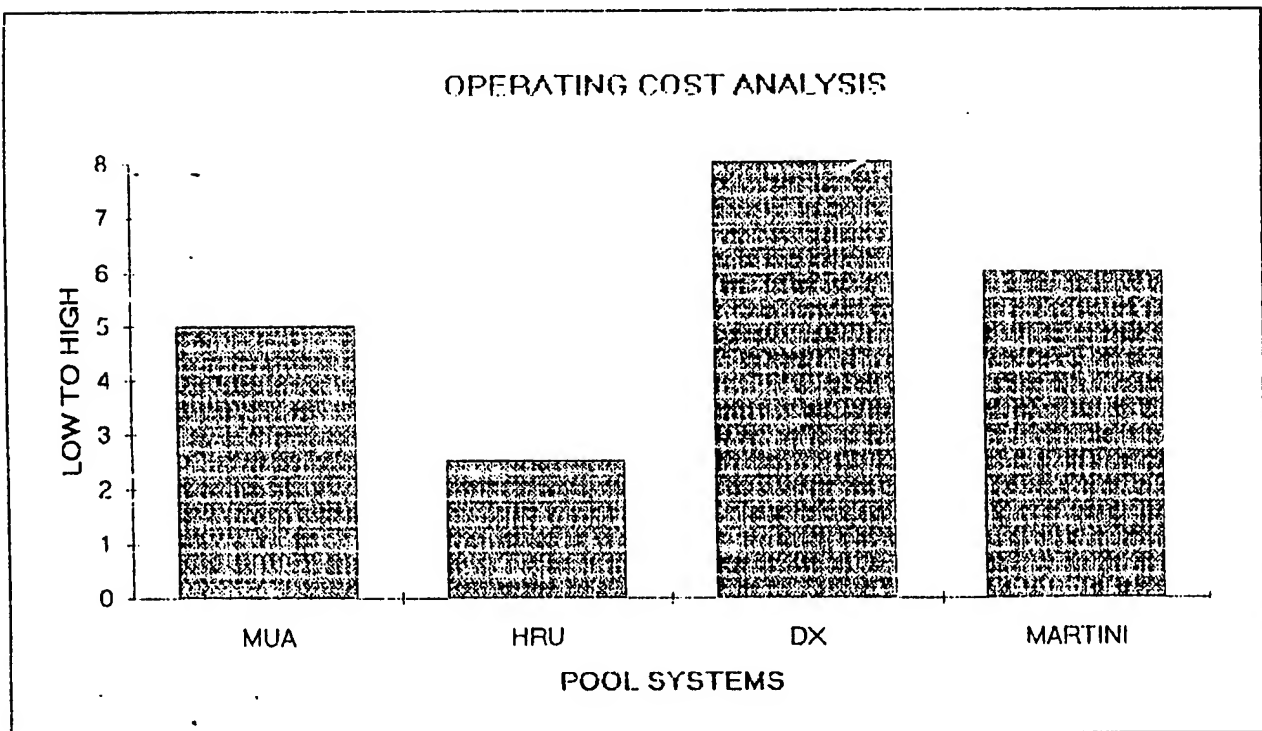


SUMMER OPERATION

APPENDIX "H"



APPENDIX "I"



CFM COMPANY

AIR CONDITIONING / HEATING / VENTILATING EQUIPMENT

2735 SOUTH RARITAN STREET
ENGLEWOOD, COLORADO 80110-1182

PHONE: 303-761-2291
TELEFAX: 303-761-0325

DATE 3/3/95
PAGE 1 OF 2
(Including this sheet)

TO: Mr Allen Neumeyer
Erne Engineering
Box 985-2527

SUBJECT: FE Reply KS
Pool Units

REMARKS:

Allen: Enclosed is the Budget Pricing you requested
for a MZP-8704 & 3 Martini 2000 Pool Unit in FA.

MZP-8704 \Rightarrow \$25,323.00 = 4,500 CFM (Z-PACK UNIT)

Martini-2000 \Rightarrow 2012 \Rightarrow \$49,605.00

Martini-2000 2016 \Rightarrow \$58,820.00

Martini-2000 2024 \Rightarrow \$72,045.00

Please call if you have any questions

for a 9,000 CFM Z-Pack = MZP8710 = \$43,650

24,000 CFM Z-Pack = PV24 = \$100,600

Thanks Jerry K. K.

☐ PLEASE REPLY

CFM 103 9/94

D9-96

9852527 P.01

TO

03/03/1995 13:47 FROM CFM COMPANY

BUILDING 7739 ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	679.99	416.91	263.08	101.39
Annual Natural Gas (MBTU)	185.29	280.54	-95.25	-36.71
Electric Demand June (KW)	58.54	44.88	13.66	5.26
Electric Demand July (KW)	60.91	47.47	13.44	5.18
Electric Demand August (KW)	63.88	50.09	13.79	5.31

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7806 (sq.ft.)	11310
ECO Model Bldg 7739 (sq.ft.)	4359
Square Footage Adjustment Factor	0.385

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:
				C. Wohler

1. INVESTMENT: BLDG 7739 - Replace MZ w/ VAV AHU

A. CONSTRUCTION COST	=	\$24,649
B. SIOH COST	(5.5% of 1A) =	\$1,356
C. DESIGN COST	(6.0% of 1A) =	\$1,479
D. TOTAL COST	(1A + 1B + 1C) =	\$27,484
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$27,484

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	101	\$1,227	15.88	\$19,483
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(37)	(\$151)	18.30	(\$2,768)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$283	14.88	\$4,211
F. TOTAL		65	\$1,359		-----> \$20,926

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$14,830	5	0.863	\$12,798
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$14,830			\$12,798

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$12,798

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$2,100
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	13.09
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$33,724
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.23

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET 1 OF 1		DATE PREPARED 4-May-95		ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 7739							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5	AHU8000	8,000 CFM AHU, COOLING ONLY	EA	1.0	\$4,433.18	\$4,433	Q-6	40	\$804
6	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA	1.0	\$310.08	\$310	1-SHEE	1.48	\$31
7	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA	2.0	\$287.31	\$575	1-SHEE	1.33	\$55
8	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB	650.0	\$0.47	\$302	Q-10	0.098	\$1,238
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA	3.0	\$24.23	\$73	1-ELEC	0.8	\$50
10	WIRE#12	COPPER WIRING #12	C.L.F.	2.5	\$7.41	\$19	1-ELEC	0.727	\$38
11	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	30.0	\$3.91	\$117	Q-1	0.25	\$145
12	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	180.0	\$2.10	\$378	Q-1	0.151	\$527
13		FITTINGS ADD 5%				\$25			\$34
14	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	30.0	\$1.46	\$44	Q-14	0.084	\$46
15	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	180.0	\$0.62	\$112	Q-14	0.073	\$242
16	CNTV1.5	CONTROL VALVE 1-1/2"	EA	1.0	\$276.17	\$276	1-PLUM	0.727	\$16
17	CNTV0.75	CONTROL VALVE 3/4"	EA	3.0	\$153.10	\$459	1-PLUM	0.444	\$29
18	VSD5	VARIABLE SPEED DRIVE W/ CONTRLER,5HP	EA	1.0	\$2,444.79	\$2,445	1-ELEC	10.5	\$220
19	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA	1.0	\$154.07	\$154	Q-5	1.32	\$26
20	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA	2.0	\$138.57	\$277	Q-5	1.32	\$51
21									
22									
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26	AHU DEMO		TON	2.8			Q-5	17.778	\$948
27	DUCT DEMO		L.F.	75.0			1-CLAB	0.119	\$129
28	ASBESTOS REMOVAL		GLV. BAG	8.0	\$170.00	\$1,360			
29									
30									
31		SUBTOTAL				\$11,359			\$4,629
32	OH	OVERHEAD			17%	\$1,908			\$778
33	PRO	PROFIT			10%	\$1,327			\$541
34	CONT	CONTINGENCY			20%	\$2,919			\$1,189
35	TOTAL COST		-	-	-	\$17,513	-	-	\$7,136

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET		1	OF 1
ENGINEER		E M C Engineers, Inc. Denver, CO				DATE PREPARED		4-May-95	
						ESTIMATOR		C. Wohler	
						CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 7739							
2		NON-RECURRING							
3									
4		EXISTING SYSTEM REPLACEMENT							
5	AHUH8000	8,000 CFM AHU	EA.	1.0	\$5,319.81	Q-6	42	\$844	\$6,164
6	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	650.0	\$0.47	Q-10	0.098	\$1,238	\$1,540
7	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	3.0	\$24.23	1-ELEC	0.8	\$50	\$123
8	WIRE#12	COPPER WIRING #12	C.L.F.	2.5	\$7.41	1-ELEC	0.727	\$38	\$57
9	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	30.0	\$3.91	Q-1	0.25	\$145	\$263
10		FITTINGS ADD 5%			\$6			\$7	\$13
11	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	30.0	\$1.46	Q-14	0.084	\$46	\$90
12	CNTV1.5	CONTROL VALVE 1-1/2"	EA.	1.0	\$276.17	1-PLUM	0.727	\$16	\$292
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25		EXISTING SYSTEMS DEMOLITION							
26	AHU DEMO		TON	2.8		Q-5	17.778	\$948	\$948
27	DUCT DEMO		L.F.	75.0		1-CLAB	0.119	\$129	\$129
28									
29									
30									
31		SUBTOTAL							
32	OH	OVERHEAD			\$6,157			\$3,462	\$9,619
33	PRO	PROFIT			\$1,034			\$582	\$1,616
34	CONT	CONTINGENCY			\$719			\$404	\$1,123
35	TOTAL COST				\$1,582			\$890	\$2,472
					\$9,492			\$5,338	\$14,830

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET		1		OF		1	
		DATE PREPARED		4-Mar-95					
		ESTIMATOR		C. Wohler					
		CHECKED BY		A. Niemeyer					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST		TOTAL	
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	TOTAL
1		BUILDING 7739							
2		ANNUAL RECURRING							
3		ANNUAL MAINTENANCE COST - BASELINE							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	-	-	\$0	\$0
16									
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT							
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	-	-	\$0	\$0
30									
31									
32									
33									
34									
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS		-	-	-	-	\$0	\$0

DEMAND LIMITING ANALYSIS BUILDING 7739

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL												
ACTUAL OR 80% PEAK												
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	5.18	5.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.26
CAPACITY (KW)	32467	34447	26136	20754	26400	22752	27108	25812	23310	21834	21996	30091
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32729	34760	26373	20775	26453	22820	27244	25916	23404	21878	22084	30456
80% SUMMER PEAK (KVA)	27808	27808	27808	27808	27808	27808	27808	27808	27808	27808	27808	27808
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32729	34760	27808	27808	27808	27808	27808	27808	27808	27808	27808	30456
ACTUAL												
ACTUAL OR 80% PEAK												
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,121.02	\$138,346.06	\$110,190.85	\$110,190.85	\$110,190.85	\$110,190.85	\$110,190.85	\$110,190.85	\$110,190.85	\$110,190.85	\$110,190.85	\$120,917.65
SUB DISCOUNT \$.20	(\$6,545.73)	(\$6,951.90)	(\$5,561.52)	(\$5,561.52)	(\$5,561.52)	(\$5,561.52)	(\$5,561.52)	(\$5,561.52)	(\$5,561.52)	(\$5,561.52)	(\$5,561.52)	(\$6,091.24)
CAPACITY CHARGE	\$126,165.29	\$133,984.16	\$107,219.33	\$107,219.33	\$107,219.33	\$107,219.33	\$107,219.33	\$107,219.33	\$107,219.33	\$107,219.33	\$107,219.33	\$117,416.41
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,213.61	\$68,198.18	\$54,558.55	\$54,558.55	\$54,558.55	\$54,558.55	\$54,558.55	\$54,558.55	\$54,558.55	\$54,558.55	\$54,558.55	\$59,755.09
100*KVA @ \$.03404	\$111,408.32	\$118,321.41	\$94,657.13	\$94,657.13	\$94,657.13	\$94,657.13	\$94,657.13	\$94,657.13	\$94,657.13	\$94,657.13	\$94,657.13	\$103,672.94
250*KVA @ \$.03084	\$252,337.87	\$267,995.91	\$209,985.16	\$184,079.56	\$214,396.73	\$214,396.73	\$214,396.73	\$214,396.73	\$214,396.73	\$212,760.76	\$171,126.76	\$234,817.39
EXCESS @ \$.02864	\$109,649.41	\$65,762.92	\$0.00	\$0.00	\$1,058.33	\$51,751.13	\$42,299.93	\$32,848.73	\$38,863.13	\$0.00	\$0.00	\$28,262.45
ENERGY CHARGE	\$537,609.21	\$520,278.43	\$359,200.84	\$333,295.24	\$364,670.74	\$415,363.54	\$405,912.34	\$396,461.14	\$402,475.54	\$361,976.44	\$320,342.44	\$426,527.86
TOTAL CHARGE LESS ECA	\$663,774.50	\$654,262.59	\$466,420.16	\$440,514.56	\$471,890.07	\$522,582.87	\$513,131.67	\$503,680.47	\$509,694.87	\$469,195.76	\$427,561.76	\$543,944.27
SUMMARY												
MONTHLY DIFFERENCE	\$28.57	\$29.33	\$19.69	\$19.69	\$23.46	\$23.46	\$23.46	\$23.46	\$23.46	\$19.69	\$19.69	\$29.14
ANNUAL DIFFERENCE.....		\$283										

BUILDING 6620A ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	581.63	386.30	195.33	175.94
Annual Natural Gas (MBTU)	573.02	582.46	-9.44	-8.50
Electric Demand June (KW)	53.52	53.90	-0.38	-0.35
Electric Demand July (KW)	55.05	56.92	-1.86	-1.68
Electric Demand August (KW)	56.69	59.58	-2.89	-2.60

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7108 (sq.ft.)	12179
ECO Model Bldg 6620A (sq.ft.)	10970
Square Footage Adjustment Factor	0.901

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Feasibility Study for HVAC Upgrade		FISCAL YEAR: 1995
ANALYSIS DATE: 05/04/95	ECONOMIC LIFE: 20	PREPARED BY: C. Wohler

1. INVESTMENT: BLDG 6620 - Convert MZ AHU to VAV AHU

A. CONSTRUCTION COST	=	\$11,727
B. SIOH COST	(5.5% of 1A) =	\$645
C. DESIGN COST	(6.0% of 1A) =	\$704
D. TOTAL COST	(1A + 1B + 1C) =	\$13,076
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$13,076

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	JAN '95 DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	176	\$2,129	15.88	\$33,807
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(9)	(\$35)	18.30	(\$641)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			(\$122)	14.88	(\$1,808)
F. TOTAL		167	\$1,972		-----> \$31,358

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
(TABLE A-2)				
a. BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$0			\$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$1,972
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	6.63
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$31,358
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	2.40

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade							
ENGINEER		E M C Engineers, Inc. Denver, CO							
		SHEET		1		OF		1	
		DATE PREPARED		4-May-95					
		ESTIMATOR		C. Wohliert					
		CHECKED BY		A. Niemeyer					
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	
1		BUILDING 6620							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		MZ AHU CONVERSION TO VAV							
5	VAVBX5	VAV BOX, 500 CFM, ELEC	EA.	2.0	\$266.48	\$533	1-SHEE	0.98	\$41
6	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	1.0	\$269.38	\$269	1-SHEE	1.0	\$21
7	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	2.0	\$279.07	\$558	1-SHEE	1.22	\$51
8	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	\$310.08	\$620	1-SHEE	1.48	\$62
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	7.0	\$24.23	\$170	1-ELEC	0.8	\$117
10	WIRE#12	COPPER WIRING #12	C.L.F.	3.5	\$7.41	\$26	1-ELEC	0.73	\$53
11	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER, 7.5HP	EA.	1.0	\$2,728.70	\$2,729	1-ELEC	12.5	\$262
12	ELE-SWIT	DDC SWITCH	EA.	1.0	\$69.77	\$70	1-STPI	0.5	\$11
13	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	300.0	\$0.47	\$140	Q-10	0.094	\$548
14	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	250.0	\$0.83	\$208	Q-14	0.053	\$244
15	ACTUAT	SMALL ELECTRIC ACTUATOR	EA.	7.0	\$96.90	\$678	1-ELEC	0.35	\$51
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27		EXISTING SYSTEMS DEMOLITION							
28		SELECTIVE DUCT DEMOLITION	LB	300.0			Q-5	0.025	\$145
29									
30									
31		SUBTOTAL				\$6,001			\$1,606
32	OH	OVERHEAD			17%	\$1,008			\$270
33	PRO	PROFIT			10%	\$701			\$188
34	CONT	CONTINGENCY			20%	\$1,542			\$413
35	TOTAL COST					\$9,252			\$2,475
									\$7,606
									\$1,278
									\$888
									\$1,955
									\$11,727

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT										DATE PREPARED			
Fort Riley Feasibility Study for HVAC Upgrade										4-May-95			
ENGINEER										ESTIMATOR			
E M C Engineers, Inc.										C. Wohler			
Denver, CO										CHECKED BY			
										A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST		Total	TOTAL				
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit						
1		BUILDING 6620											
2		NON-RECURRING											
3													
4		EXISTING SYSTEM REPLACEMENT											
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32	OH	SUBTOTAL						\$0	\$0				
33	PRO	OVERHEAD			17%			\$0	\$0				
34	CONT	PROFIT			10%			\$0	\$0				
35	TOTAL COST	CONTINGENCY			20%			\$0	\$0				

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade								DATE PREPARED		4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO								ESTIMATOR		C. Wohler	
										CHECKED BY		A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	TOTAL			
1		BUILDING 6620											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0	\$0			
16		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-	\$0	-	-	\$0	\$0			
30													
31													
32													
33													
34													
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-	\$0	-	-	\$0	\$0			

DEMAND LIMITING ANALYSIS BUILDING 6620A

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42
DEMAND REDUCTION (KW)	(1.68)	(2.60)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.35)
CAPACITY (KW)	32474	34455	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32736	34768	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32736	34768	27814	27814	27814	27814	27814	27814	27814	27814	27814	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00
REMAINING @ \$4.05	\$130,149.03	\$138,378.41	\$110,216.73	\$110,216.73	\$110,216.73	\$110,216.73	\$110,216.73	\$110,216.73	\$110,216.73	\$110,216.73	\$110,216.73	\$120,940.65
SUB DISCOUNT \$.20	(\$6,547.11)	(\$6,953.50)	(\$5,562.80)	(\$5,562.80)	(\$5,562.80)	(\$5,562.80)	(\$5,562.80)	(\$5,562.80)	(\$5,562.80)	(\$5,562.80)	(\$5,562.80)	(\$6,092.38)
CAPACITY CHARGE	\$126,191.91	\$134,014.91	\$107,243.93	\$107,243.93	\$107,243.93	\$107,243.93	\$107,243.93	\$107,243.93	\$107,243.93	\$107,243.93	\$107,243.93	\$117,438.27
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ \$.03924	\$64,227.17	\$68,213.85	\$54,571.08	\$54,571.08	\$54,571.08	\$54,571.08	\$54,571.08	\$54,571.08	\$54,571.08	\$54,571.08	\$54,571.08	\$59,766.23
100*KVA @ \$.03404	\$111,431.85	\$118,348.60	\$94,678.88	\$94,678.88	\$94,678.88	\$94,678.88	\$94,678.88	\$94,678.88	\$94,678.88	\$94,678.88	\$94,678.88	\$103,692.27
250*KVA @ \$.03084	\$252,391.18	\$268,057.49	\$209,955.60	\$184,050.00	\$214,445.99	\$214,445.99	\$214,445.99	\$214,445.99	\$214,445.99	\$212,731.20	\$171,097.20	\$234,861.17
EXCESS @ \$.02864	\$109,570.20	\$65,671.42	\$0.00	\$0.00	\$985.14	\$51,677.94	\$42,226.74	\$32,775.54	\$38,789.94	\$0.00	\$0.00	\$28,217.39
ENERGY CHARGE	\$537,620.41	\$520,291.36	\$359,205.56	\$333,299.96	\$364,681.09	\$415,373.89	\$405,922.69	\$396,471.49	\$402,485.89	\$361,981.16	\$320,347.16	\$426,537.06
TOTAL CHARGE LESS ECA	\$663,812.33	\$654,306.27	\$466,449.49	\$440,543.89	\$471,925.02	\$522,617.82	\$513,166.62	\$503,715.42	\$509,729.82	\$469,225.09	\$427,591.09	\$543,975.34
SUMMARY												
MONTHLY DIFFERENCE	(\$9.25)	(\$14.36)	(\$9.64)	(\$9.64)	(\$11.48)	(\$11.48)	(\$11.48)	(\$11.48)	(\$11.48)	(\$9.64)	(\$9.64)	(\$1.92)
ANNUAL DIFFERENCE.....		(\$121.50)										

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914-6620 EXCHANGE MAIN RETAIL
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 14 RECTANGULAR 14 OTHER 0
 (U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)	AZIMUTH
SPACE 1		0.000	0.00	0.065	190.00	0.065	190.00	0.065	190.00	190.00	NORTH
SPACE 3		0.000	0.00	0.065	360.00	0.065	360.00	0.065	360.00	360.00	NORTH
SPACE 4		0.000	0.00	0.065	220.00	0.065	220.00	0.065	220.00	220.00	NORTH
PLENUM 1		0.000	0.00	0.094	429.00	0.094	429.00	0.094	429.00	429.00	NORTH
SPACE 4		0.000	0.00	0.103	420.00	0.103	420.00	0.103	420.00	420.00	EAST
PLENUM 1		0.000	0.00	0.094	924.00	0.094	924.00	0.094	924.00	924.00	EAST
SPACE 1		0.490	133.65	0.103	1136.35	0.144	1136.35	0.144	1136.35	1270.00	EAST
SPACE 2		0.000	0.00	0.065	420.00	0.065	420.00	0.065	420.00	420.00	SOUTH
PLENUM 1		0.000	0.00	0.094	429.00	0.094	429.00	0.094	429.00	429.00	SOUTH
SPACE 1		0.000	0.00	0.065	360.00	0.065	360.00	0.065	360.00	360.00	SOUTH
PLENUM 1		0.000	0.00	0.094	924.00	0.094	924.00	0.094	924.00	924.00	WEST
SPACE 2		0.490	74.25	0.103	695.75	0.141	695.75	0.141	695.75	770.00	WEST
SPACE 3		0.490	29.70	0.103	880.30	0.116	880.30	0.116	880.30	910.00	WEST
PLENUM 1		0.000	0.00	0.128	17160.00	0.128	17160.00	0.128	17160.00	17160.00	ROOF
SPACE 1		0.000	0.00	0.020	4445.00	0.020	4445.00	0.020	4445.00	4445.00	UNDERGRND
SPACE 2		0.000	0.00	0.020	3234.00	0.020	3234.00	0.020	3234.00	3234.00	UNDERGRND
SPACE 3		0.000	0.00	0.020	3570.00	0.020	3570.00	0.020	3570.00	3570.00	UNDERGRND
SPACE 4		0.000	0.00	0.020	924.00	0.020	924.00	0.020	924.00	924.00	UNDERGRND

D11-7

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 LDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914 EXCHANGE MAIN RETAIL
 REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.000	0.076	0.076	0.00	1199.00	1199.00
EAST	0.490	0.100	0.120	133.65	2480.35	2614.00
SOUTH	0.000	0.076	0.076	0.00	1209.00	1209.00
WEST	0.490	0.100	0.115	103.95	2500.05	2604.00
ROOF	0.000	0.128	0.128	0.00	17160.00	17160.00
ALL WALLS	0.490	0.092	0.104	237.60	7388.40	7626.00
WALLS+ROOFS	0.490	0.117	0.120	237.60	24548.40	24786.00
UNDERGRND	0.000	0.020	0.020	0.00	12173.00	12173.00
BUILDING	0.490	0.085	0.087	237.60	36721.40	36959.00

*** BUILDING ***

FLOOR AREA 12179 SQFT 1131 SQMT
VOLUME 188775 CUFT 5346 CUMT

COOLING LOAD
=====

TIME	AUG 24	6PM
DRY-BULB TEMP	93F	34C
WET-BULB TEMP	76F	24C

HEATING LOAD
=====

JAN 16	6AM
10F	-12C
8F	-13C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	5.905	1.729	0.000	0.000	-28.955	-8.480
ROOFS	0.000	0.000	0.000	0.000	0.000	0.000
GLASS CONDUCTION	2.382	0.698	0.000	0.000	-8.267	-2.421
GLASS SOLAR	6.870	2.012	0.000	0.000	0.609	0.178
DOOR	2.310	0.677	0.000	0.000	-6.229	-1.824
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.152	-0.337	0.000	0.000	-6.990	-2.047
OCCUPANTS TO SPACE	14.248	4.173	25.373	7.431	0.031	0.009
LIGHT TO SPACE	53.232	15.590	0.000	0.000	0.177	0.052
EQUIPMENT TO SPACE	9.050	2.650	0.000	0.000	0.020	0.006
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	7.706	2.257	11.955	3.501	-19.339	-5.664
TOTAL	100.551	29.449	37.328	10.933	-68.942	-20.191
TOTAL LOAD	137.880	KBTU/H	40.382	KW	-68.942	KBTU/H
TOTAL LOAD / AREA	11.32	BTU/H.SQFT	35.690	W /SQMT	5.661	BTU/H.SQFT
						W /SQMT

* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *

* ---- LOADS *

* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *

* IN CONSIDERATION *

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-97.658	15	-6.F	-7.F	-269.834	10297.	26.603
FEB	0.00000				0.000	-72.351	3	-1.F	-2.F	-234.104	9308.	26.603
MAR	0.00000				0.000	-53.819	14	16.F	15.F	-190.372	10790.	26.603
APR	0.00000				0.000	-15.907	5	31.F	29.F	-128.261	10132.	26.603
MAY	32.54854	31	18	90.F	76.F	-2.893	9	45.F	44.F	-81.411	10297.	26.603
JUN	79.81097	29	15	88.F	75.F	0.000				0.000	10378.	26.603
JUL	98.05341	7	18	83.F	74.F	0.000				0.000	10050.	26.603
AUG	99.07893	4	17	92.F	70.F	0.000				0.000	10790.	26.603
SEP	51.91270	7	15	92.F	76.F	0.000				0.000	10132.	26.603
OCT	0.32368	1	18	83.F	68.F	-13.963	2	64.F	59.F	-176.391	10050.	26.603
NOV	0.00000				0.000	-45.483	3	13.F	12.F	-183.070	9885.	26.603
DEC	0.00000				0.000	-86.754	15	8.F	7.F	-229.569	10297.	26.603
TOTAL	361.729					-388.826					122407.	
MAX					291.979					-269.834		26.603

D11-3

MONTH	N U M B E R O F H O U R S										--COINCIDENT LOADS--	
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)	
JAN	0	744	0	0	744	0	744	0	0	-118.080	6.882	
FEB	0	672	0	0	672	0	672	0	0	-121.898	6.882	
MAR	0	744	0	0	744	0	744	0	0	-117.566	6.882	
APR	0	720	0	0	720	0	720	0	0	-0.036	6.882	
MAY	338	360	0	46	360	384	744	0	46	0.000	26.603	
JUN	688	0	0	32	0	720	720	0	32	0.000	26.603	
JUL	740	0	0	4	0	744	744	0	4	0.000	26.603	
AUG	727	0	0	17	0	744,	744	0	17	0.000	26.603	
SEP	513	0	0	207	0	720	720	0	207	0.000	26.603	
OCT	10	720	0	14	720	24	744	0	14	0.000	6.882	
NOV	0	720	0	0	720	0	720	0	0	-138.580	6.882	
DEC	0	744	0	0	744	0	744	0	0	-158.907	6.882	
ANNUAL	3016	5424	0	320	5424	3336	8760	0	320			

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 40.189 97.975 31/11 36.203 97.975 28/11 40.856 97.975 31/10 36.709 97.975 15/ 8 48.449 183.475 31/18 65.374 182.657 28/16 70.682 187.901 22/16 74.395 193.495 11/16 54.750 183.507 7/16 36.540 97.975 20/10 37.350 97.975 30/12 40.128 97.975 30/18	NATURAL-GAS 136.994 339.352 15/ 8 105.060 301.456 3/ 5 81.006 253.804 14/ 4 26.754 183.724 5/ 5 5.682 128.996 9/ 5 0.000 0.000 30/ 1 0.000 0.000 31/ 1 0.000 0.000 31/ 1 0.000 0.000 30/ 1 23.955 238.275 2/ 2 69.199 245.711 3/ 5 124.365 296.580 15/ 5
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	40.189 97.975 31/11	136.994 339.352 15/ 8
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	36.203 97.975 28/11	105.060 301.456 3/ 5
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	40.856 97.975 31/10	81.006 253.804 14/ 4
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	36.709 97.975 15/ 8	26.754 183.724 5/ 5
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	48.449 183.475 31/18	5.682 128.996 9/ 5
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	65.374 182.657 28/16	0.000 0.000 30/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	70.682 187.901 22/16	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	74.395 193.495 11/16	0.000 0.000 31/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	54.750 183.507 7/16	0.000 0.000 30/ 1
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	36.540 97.975 20/10	23.955 238.275 2/ 2
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	37.350 97.975 30/12	69.199 245.711 3/ 5
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	40.128 97.975 30/18	124.365 296.580 15/ 5
	ONE YEAR USE/PEAK	581.624 193.495	573.016 339.352

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 PDL RUN 1
 DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914 6620 EXCHANGE MAIN RETAIL
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	20.56	573.02
SPACE COOL	125.35	0.00
HVAC AUX	223.60	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	182.00	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	30.11	0.00
TOTAL	581.63	573.02

TOTAL SITE ENERGY 1154.64 MBTU 94.1 KBTU/SQFT-YR GROSS-AREA 94.8 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 2319.63 MBTU 189.0 KBTU/SQFT-YR GROSS-AREA 190.5 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 1.4
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 8:11: 2 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6914 6620 EXCHANGE MAIN RETAIL
 REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR VAV-FN-SYS TOPEKA, KS

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-94.394	15	-8.F	-9.F	-187.946	5469.	20.114
FEB	0.00000				0.000	-74.759	3	-5.F	-6.F	-177.294	4947.	20.114
MAR	0.00000				0.000	-59.635	4	7	14.F	12.F	6059.	28.126
APR	0.00000				0.000	-23.133	5	5	31.F	29.F	6392.	28.237
MAY	21.86016	31	18	90.F	76.F	-5.864	1	7	38.F	36.F	6516.	28.237
JUN	58.67118	29	15	88.F	75.F	0.000				0.000	6536.	27.031
JUL	75.76686	7	18	83.F	74.F	0.000				0.000	6338.	28.237
AUG	78.28471	4	17	92.F	70.F	0.000				0.000	7269.	28.237
SEP	36.34599	7	16	93.F	76.F	0.000				0.000	5879.	26.872
OCT	0.50520	1	17	85.F	68.F	-21.400	20	5	25.F	25.F	6117.	28.237
NOV	0.00000				0.000	-51.569	3	6	13.F	12.F	5428.	28.237
DEC	0.00000				0.000	-86.561	13	8	0.F	-1.F	5469.	20.114
TOTAL	271.434					-417.315					72417.	
MAX					302.770					-187.946		28.237

D11-1

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 8:11: 2 SDL RUN 1
 DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6914 EXCHANGE MAIN RETAIL
 REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR VAV-FN-SYS TOPEKA, KS

MONTH	N U M B E R O F H O U R S										COINCIDENT LOADS--		
	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS NIGHT VENTING	HOURS FLOTTING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)		
JAN	0	744	0	0	744	0	744	0	0	-124.823	0.392		
FEB	0	672	0	0	672	0	672	0	0	-125.219	0.392		
MAR	0	715	0	29	744	0	744	0	0	-118.789	0.392		
APR	0	571	0	149	720	0	720	0	149	-50.695	0.392		
MAY	384	246	0	114	360	384	744	0	114	0.000	24.952		
JUN	720	0	0	0	0	720	720	0	0	0.000	26.845		
JUL	744	0	0	0	0	744	744	0	0	0.000	28.237		
AUG	720	0	0	0	0	720	744	0	0	0.000	28.216		
SEP	24	563	0	157	720	24	744	0	157	0.000	26.458		
OCT	0	671	0	49	720	0	744	0	49	-133.130	0.392		
NOV	0	744	0	0	744	0	744	0	0	-132.636	0.392		
DEC	0												
ANNUAL	3336	4926	0	498	5424	3336	8760	0	498				

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY TOTAL (MBTU) PEAK (KBTU) DY/HR	NATURAL-GAS TOTAL (MBTU) PEAK (KBTU) DY/HR
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	22.345 73.650 31/18	126.270 236.367 15/ 6
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	20.194 73.650 28/14	102.243 225.149 3/ 7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.904 96.036 9/18	84.302 197.889 4/ 7
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.782 97.635 20/ 8	35.717 169.101 5/ 5
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	33.342 172.566 31/18	9.664 136.669 1/ 7
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	47.535 183.971 29/16	0.000 0.000 30/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	52.552 194.258 22/18	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	57.407 203.350 11/16	0.000 0.000 31/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	38.304 182.804 7/16	0.000 0.000 30/ 1
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	23.179 97.391 6/ 8	33.435 177.410 20/ 5
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	21.455 96.413 23/18	73.548 196.926 3/ 6
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	22.303 73.650 30/18	117.279 221.726 13/ 8
	ONE YEAR USE/PEAK	386.301 203.350	582.457 236.367

ENERGY TYPE		ELECTRICITY		NATURAL-GAS	
IN SITE MBTU -					
CATEGORY OF USE					
SPACE HEAT		17.26		582.46	
SPACE COOL		104.66		0.00	
HVAC AUX		52.27		0.00	
DOM HOT WTR		0.00		0.00	
AUX SOLAR		0.00		0.00	
LIGHTS		182.00		0.00	
VERT TRANS		0.00		0.00	
MISC EQUIP		30.11		0.00	
TOTAL		386.30		582.46	

TOTAL SITE ENERGY 968.76 MBTU 78.9 KBTU/SQFT-YR GROSS-AREA 79.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1742.52 MBTU 142.0 KBTU/SQFT-YR GROSS-AREA 143.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 23.9
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 6620B ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	488.48	297.61	190.87	477.55
Annual Natural Gas (MBTU)	797.55	717.95	79.60	199.16
Electric Demand June (KW)	40.39	35.06	5.32	13.32
Electric Demand July (KW)	44.28	39.98	4.30	10.75
Electric Demand August (KW)	42.76	38.94	3.82	9.56

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7086 (sq.ft.)	4590
ECO Model Bldg 6620B (sq.ft.)	11484
Square Footage Adjustment Factor	2.502

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO:	1406-005	
PROJECT TITLE:	Feasibility Study for HVAC Upgrade		FISCAL YEAR:	1995	
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohler

1. INVESTMENT: BLDG 6620 - Replace SZs AHUs w/ VAV AHUs

A. CONSTRUCTION COST	=	\$42,220
B. SIOH COST	(5.5% of 1A) =	\$2,322
C. DESIGN COST	(6.0% of 1A) =	\$2,533
D. TOTAL COST	(1A + 1B + 1C) =	\$47,075
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$47,075

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	478	\$5,778	15.88	\$91,760
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	199	\$821	18.30	\$15,016
D. COAL	\$0.00	0	\$0	16.62	\$0
E. ELEC. DEMAND			\$539	14.88	\$8,016
F. TOTAL		677	\$7,138		-----> \$114,793

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
1 ANNUAL MAINTENANCE			14.88	\$0
2			14.88	\$0
3			14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST				\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$30,326	5	0.863	\$26,171
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$30,326			\$26,171

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$26,171

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$8,654
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	5.44
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$140,964
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =	2.99

(MUST HAVE SIR > 1.25 TO QUALIFY)

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT		Fort Riley Feasibility Study for HVAC Upgrade				SHEET 1 OF 1		DATE PREPARED 4-May-95	
ENGINEER		E M C Engineers, Inc. Denver, CO				ESTIMATOR C. Wohler		CHECKED BY A. Niemeyer	
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST		LABOR COST			TOTAL
				Quantity	Unit Cost	Crew/ Worker	Hours/ Unit	Total	
1		BUILDING 6620							
2		PROPOSED SYSTEM MODIFICATIONS							
3									
4		NEW SYSTEMS INSTALLATION							
5	AHU10000	10,000 CFM AHU, COOLING ONLY	EA.	2.0	\$4,820.78	Q-6	44.44	\$1,787	\$11,429
6	REHEAT4	REHEAT COIL, 2ROW, 3' x 2'	EA.	2.0	\$193.80	Q-5	3.96	\$154	\$541
7	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	2.0	\$154.07	Q-5	1.3	\$51	\$359
8	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	\$310.08	1-SHEE	1.48	\$62	\$682
9	VAVBX70	VAV BOX, 7000 CFM, ELEC	EA.	2.0	\$353.69	1-SHEE	2.6	\$108	\$816
10	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	145.0	\$2.10	Q-1	0.151	\$425	\$729
11	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	120.0	\$5.28	Q-15	0.34	\$791	\$1,425
12		FITTINGS, 5%						\$61	\$108
13	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	4.0	\$24.23	1-ELEC	0.8	\$67	\$164
14	WIRE#12	COPPER WIRING #12	C.L.F.	3.0	\$7.41	1-ELEC	0.73	\$46	\$68
15	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER, 7.5HP	EA.	2.0	\$2,728.70	1-ELEC	12.5	\$523	\$5,981
16	CNTV0.75	CONTROL VALVE 3/4"	EA.	4.0	\$153.10	1-PLUM	0.44	\$38	\$651
17	CNTV2	CONTROL VALVE 2"	EA.	2.0	\$397.29	1-PLUM	0.889	\$38	\$833
18	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	145.0	\$0.62	Q-14	0.073	\$195	\$285
19	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	\$1.60	Q-14	0.089	\$197	\$389
20	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	425.0	\$0.47	Q-10	0.098	\$809	\$1,007
21	DTINSL2"	DUCT INSULATION, 2" THICK	S.F.	356.0	\$0.83	Q-14	0.053	\$347	\$644
22									
23									
24									
25									
26									
27		EXISTING SYSTEMS DEMOLITION							
28		AHU DEMO	TON	3.7		Q-5	17.778	\$1,275	\$1,275
29									
30									
31		SUBTOTAL			\$20,410			\$6,974	\$27,384
32	OH	OVERHEAD			17%			\$1,172	\$4,601
33	PRO	PROFIT			10%			\$815	\$3,198
34	CONT	CONTINGENCY			20%			\$1,792	\$7,037
35	TOTAL COST				\$31,467			\$10,753	\$42,220

ENGINEER'S OPINION OF PROBABLE COST									
PROJECT				Fort Riley Feasibility Study for HVAC Upgrade			SHEET 1 OF 1		
ENGINEER				E M C Engineers, Inc. Denver, CO			DATE PREPARED 4-May-95		
							ESTIMATOR C. Wohliert		
							CHECKED BY A. Niemeyer		
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST		
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total
1		BUILDING 6620							
2		NON-RECURRING							
3		EXISTING SYSTEM REPLACEMENT							
4		10,000 CFM AHU	EA.	2.0	\$5,784.93	\$11,570	Q-6	46.67	\$1,877
5	AHUH10000	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	120.0	\$5.28	\$634	Q-15	0.34	\$791
6	STLPIP2.5	FITTINGS, 5%				\$32			\$40
7		SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	\$24.23	\$48	1-ELEC	0.8	\$33
8	E-TSTAT1	COPPER WIRING #12	C.L.F.	1.5	\$7.41	\$11	1-ELEC	0.73	\$23
9	WIRE#12	CONTROL VALVE 2"	EA.	4.0	\$397.29	\$1,589	1-PLUM	0.889	\$77
10	CNTV2	2.5" FIBERGLASS PIPE INSULATION, 1.5" THICK	EA.	120.0	\$1.60	\$192	Q-14	0.089	\$197
11	INSLPIP2.5	GAL. STEEL DUCTWORK, 200 TO 500 LB.	L.F.	350.0	\$0.47	\$163	Q-10	0.098	\$666
12	DUCT500	DUCT INSULATION, 2" THICK	S.F.	250.0	\$0.83	\$208	Q-14	0.053	\$244
13	DTINSL2"								
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27		EXISTING SYSTEMS DEMOLITION							
28		AHU DEMO	TON	3.7			Q-5	17.778	\$1,275
29									
30									
31		SUBTOTAL				\$14,447			\$19,670
32	OH	OVERHEAD			17%	\$2,427			\$3,304
33	PRO	PROFIT			10%	\$1,687			\$2,297
34	CONT	CONTINGENCY			20%	\$3,712			\$5,054
35	TOTAL COST					\$22,274			\$30,326

ENGINEER'S OPINION OF PROBABLE COST										SHEET	1	OF	1
PROJECT Fort Riley Feasibility Study for HVAC Upgrade										DATE PREPARED 2-Mar-95			
ENGINEER E M C Engineers, Inc. Denver, CO										ESTIMATOR C. Wohler			
										CHECKED BY A. Niemeyer			
Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			Total			
				Quantity	Unit Cost	Unit	Crew/ Worker	Hours/ Unit	Total				
1		BUILDING 6620											
2		ANNUAL RECURRING											
3		ANNUAL MAINTENANCE COST - BASELINE											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-					\$0		\$0	\$0
16													
17		ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT											
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29		TOTAL ANNUAL MAINTENANCE COST - BASELINE	-	-	-					\$0		\$0	\$0
30													
31													
32													
33													
34													
35		TOTAL ANNUAL MAINTENANCE COST SAVINGS	-	-	-					\$0		\$0	\$0

DEMAND LIMITING ANALYSIS BUILDING 6620B

SUMMER PEAK (KW) = 27812	1993												1993 JUN BILL 6/1-7/1 ACTUAL
	JUL BILL 7/1-8/2 ACTUAL	AUG BILL 8/2-9/1 ACTUAL	SEP BILL 9/3-10/1 ACTUAL	OCT BILL 10/1-11/1 ACTUAL	NOV BILL 11/1-12/1 ACTUAL	DEC BILL 12/1-1/3 ACTUAL	JAN BILL 1/4-2/1 ACTUAL	FEB BILL 2/1-3/1 ACTUAL	MAR BILL 3/3-4/1 ACTUAL	APR BILL 4/1-5/3 ACTUAL	MAY BILL 5/3-6/1 ACTUAL		
BASE CASE													
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096	
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%	
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462	
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	
BILLING CAPACITY (KVA)	32734	34765	27812	27804	27804	27804	27804	27804	27804	27804	27804	30462	
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL	
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	
REMAINING @ \$4.05	\$130,142.18	\$138,367.78	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$110,208.22	\$120,939.23	
SUB DISCOUNT \$.20	(\$6,546.77)	(\$6,952.98)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$5,562.38)	(\$6,092.31)	
CAPACITY CHARGE	\$126,185.40	\$134,004.80	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$107,235.84	\$117,436.92	
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000	
50*KVA @ \$.03924	\$64,223.85	\$68,208.70	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$54,566.96	\$59,765.54	
100*KVA @ \$.03404	\$111,426.10	\$118,339.66	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$94,671.73	\$103,691.08	
250*KVA @ \$.03084	\$252,378.15	\$268,037.26	\$209,965.32	\$184,059.72	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$214,429.80	\$212,740.92	\$171,106.92	\$234,858.46	
EXCESS @ \$.02864	\$109,589.57	\$65,701.49	\$0.00	\$0.00	\$1,009.19	\$51,701.99	\$42,250.79	\$32,799.59	\$38,813.99	\$0.00	\$0.00	\$28,221.42	
ENERGY CHARGE	\$537,617.67	\$520,287.11	\$359,204.01	\$333,298.41	\$364,677.69	\$415,370.49	\$405,919.29	\$396,468.09	\$402,482.49	\$361,979.61	\$320,345.61	\$426,536.49	
TOTAL CHARGE LESS ECA	\$663,803.07	\$654,291.92	\$466,439.85	\$440,534.25	\$471,913.53	\$522,606.33	\$513,155.13	\$503,703.93	\$509,718.33	\$469,215.45	\$427,581.45	\$543,973.42	
DEMAND REDUCTION (KW)	10.75	9.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.32	
CAPACITY (KW)	32461	34442	26136	20754	26400	22752	27108	25812	23310	21834	21996	30083	
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%	
CAPACITY (KVA)	32723	34755	26373	20775	26453	22820	27244	25916	23404	21878	22084	30448	
80% SUMMER PEAK (KVA)	27804	27804	27804	27804	27804	27804	27804	27804	27804	27804	27804	27804	
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	
BILLING CAPACITY (KVA)	32723	34755	27804	27804	27804	27804	27804	27804	27804	27804	27804	30448	
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL	
200 KVA @ \$4.45	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	\$890.00	
NEXT 400 @ \$4.25	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	\$1,700.00	
REMAINING @ \$4.05	\$130,098.28	\$138,328.70	\$110,176.96	\$110,176.96	\$110,176.96	\$110,176.96	\$110,176.96	\$110,176.96	\$110,176.96	\$110,176.96	\$110,176.96	\$120,884.62	
SUB DISCOUNT \$.20	(\$6,544.61)	(\$6,951.05)	(\$5,560.84)	(\$5,560.84)	(\$5,560.84)	(\$5,560.84)	(\$5,560.84)	(\$5,560.84)	(\$5,560.84)	(\$5,560.84)	(\$5,560.84)	(\$6,089.61)	
CAPACITY CHARGE	\$126,143.67	\$133,967.65	\$107,206.12	\$107,206.12	\$107,206.12	\$107,206.12	\$107,206.12	\$107,206.12	\$107,206.12	\$107,206.12	\$107,206.12	\$117,385.01	
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000	
50*KVA @ \$.03924	\$64,202.59	\$68,189.77	\$54,551.81	\$54,551.81	\$54,551.81	\$54,551.81	\$54,551.81	\$54,551.81	\$54,551.81	\$54,551.81	\$54,551.81	\$59,739.08	
100*KVA @ \$.03404	\$111,389.20	\$118,306.81	\$94,645.45	\$94,645.45	\$94,645.45	\$94,645.45	\$94,645.45	\$94,645.45	\$94,645.45	\$94,645.45	\$94,645.45	\$103,645.18	
250*KVA @ \$.03084	\$252,294.57	\$267,962.85	\$210,001.03	\$184,095.43	\$214,370.28	\$214,370.28	\$214,370.28	\$214,370.28	\$214,370.28	\$212,776.63	\$171,142.63	\$234,754.50	
EXCESS @ \$.02864	*\$109,713.75	\$65,812.05	\$0.00	\$0.00	\$1,097.64	\$51,790.44	\$42,339.24	\$32,888.04	\$38,902.44	\$0.00	\$0.00	\$28,375.89	
ENERGY CHARGE	\$537,600.11	\$520,271.48	\$359,198.30	\$333,292.70	\$364,665.18	\$415,357.98	\$405,906.78	\$396,455.58	\$402,469.98	\$361,973.90	\$320,339.90	\$426,514.65	
TOTAL CHARGE LESS ECA	\$663,743.78	\$654,239.13	\$466,404.42	\$440,498.82	\$471,871.30	\$522,564.10	\$513,112.90	\$503,661.70	\$509,676.10	\$469,180.02	\$427,546.02	\$543,899.65	
SUMMARY													
MONTHLY DIFFERENCE	\$59.29	\$52.79	\$35.44	\$35.44	\$42.23	\$42.23	\$42.23	\$42.23	\$42.23	\$35.44	\$35.44	\$73.76	
ANNUAL DIFFERENCE.....		\$538.74											

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/18/1995 10:19:55 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6620 COMMUN ACT CTR
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA 4590 SQFT 426 SQMT
VOLUME 123930 CUFT 3510 CUMT

COOLING LOAD
JUL 23 4PM
98F 37C
79F 26C
HEATING LOAD
JAN 4 3AM
8F -13C
7F -14C

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	8.170	2.393	0.000	0.000	-31.018	-9.084
ROOFS	12.808	3.751	0.000	0.000	-32.144	-9.414
GLASS CONDUCTION	22.230	6.511	0.000	0.000	-62.587	-18.330
GLASS SOLAR	9.508	2.785	0.000	0.000	0.436	0.128
DOOR	0.776	0.227	0.000	0.000	-1.512	-0.443
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.824	-0.241	0.000	0.000	-2.636	-0.772
OCCUPANTS TO SPACE	6.543	1.916	9.375	2.746	0.188	0.055
LIGHT TO SPACE	30.393	8.901	0.000	0.000	4.408	1.291
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	12.063	3.533	17.769	5.204	-57.812	-16.932
TOTAL	101.666	29.775	27.144	7.950	-182.676	-53.501
TOTAL LOAD	128.810	KBTU/H	37.725	KW	-182.676	KBTU/H
TOTAL LOAD / AREA	28.06	BTU/H.SQFT	88.469	W /SQMT	39.799	BTU/H.SQFT

*
* NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR
*
* LOADS
*
* 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION
*
* IN CONSIDERATION
*

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 34.207 63.692 31/17	NATURAL-GAS 178.954 395.890 15/ 3
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	30.847 63.692 28/13	140.420 359.974 3/ 6
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	33.620 63.692 31/16	120.513 322.218 3/ 4
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	30.041 63.692 17/ 7	45.762 221.743 5/ 6
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	38.573 128.126 31/16	10.928 159.225 5/ 5
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	53.673 137.835 19/10	0.000 0.000 30/ 1
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	63.026 151.130 23/16	0.000 0.000 31/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	63.397 145.941 21/10	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	44.122 139.721 6/16	0.000 0.000 30/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	30.877 87.126 1/17	39.963 228.686 20/ 6
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	31.919 63.692 30/17	96.396 285.297 2/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	34.155 63.692 31/17	164.618 363.455 15/ 5
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR		
	ONE YEAR USE/PEAK	488.456 151.130	797.554 395.890

ENERGY TYPE			
IN SITE MBTU -	ELECTRICITY	NATURAL-GAS	
CATEGORY OF USE			
SPACE HEAT	27.99	797.55	
SPACE COOL	110.94	0.00	
HVAC AUX	202.37	0.00	
DOM HOT WTR	0.00	0.00	
AUX SOLAR	0.00	0.00	
LIGHTS	147.18	0.00	
VERT TRANS	0.00	0.00	
MISC EQUIP	0.00	0.00	
TOTAL	488.48	797.55	
TOTAL SITE ENERGY	1286.01 MBTU	280.2 KBTU/SQFT-YR GROSS-AREA	280.2 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY	2264.39 MBTU	493.3 KBTU/SQFT-YR GROSS-AREA	493.3 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =	0.0		
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED	0.0		
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.			

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 8:21: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6620 COMMUN ACT CTR
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AC-1 TOPEKA, KS

MONTH	C O O L I N G				MAXIMUM COOLING LOAD (KBTU/HR)	H E A T I N G				MAXIMUM HEATING LOAD (KBTU/HR)	E L E C	
	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY- BULB TEMP	WET- BULB TEMP		TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-110.152	15	4	-8.F	-9.F	3948.	10.480
FEB	0.00000				0.000	-89.834	3	7	-5.F	-6.F	3566.	10.480
MAR	0.00000				0.000	-77.309	4	6	14.F	12.F	3948.	10.480
APR	0.00000				0.000	-32.112	5	6	31.F	28.F	4050.	18.478
MAY	14.97177	31	16	88.F	75.F	-8.234	5	6	44.F	40.F	4396.	18.478
JUN	45.36160	19	10	82.F	74.F	0.000				0.000	4184.	13.486
JUL	65.09155	24	10	80.F	75.F	0.000				0.000	4584.	14.790
AUG	64.76651	21	10	86.F	76.F	0.000				0.000	4672.	14.843
SEP	29.01475	6	16	93.F	76.F	0.000				0.000	4007.	14.061
OCT	0.54035	1	17	85.F	68.F	-28.095	20	6	24.F	23.F	4234.	18.478
NOV	0.00000				50.445	-63.147	3	5	13.F	12.F	3851.	16.208
DEC	0.00000				0.000	-102.217	13	8	0.F	-1.F	3948.	10.480
TOTAL	219.746					-511.100					49391.	
TAX					257.348					-224.370		18.478

511-25

EMC ENGINEERS INC. EDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 8:21: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6620 COMMUN ACT CTR
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR AC-1 TOPEKA, KS

MONTH	HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS		HOURS	
-------	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--	-------	--

MO	UTILITY- TOTAL (MBTU) PEAK (KBTU) DY/HR	ELECTRICITY 18.100 41.991 31/17 16.339 41.991 28/17 17.935 41.991 31/17 16.753 63.093 24.366 104.965 31/16 35.462 119.661 19/10 42.855 136.462 23/16 43.923 132.895 21/10 29.077 123.224 6/16 17.561 63.506 1/17 17.132 55.342 23/14 18.098 41.991 31/17	NATURAL-GAS 147.916 281.863 15/ 4 122.848 269.436 3/ 7 109.717 230.686 4/ 6 49.647 193.118 5/ 6 13.556 144.061 5/ 6 0.000 0.000 30/ 1 0.000 0.000 31/ 1 0.000 0.000 31/ 1 0.000 0.000 30/ 1 44.215 203.598 20/ 6 91.001 228.680 3/ 5 139.052 260.580 13/ 8
JAN	TOTAL (MBTU) PEAK (KBTU) DY/HR	18.100 41.991 31/17	147.916 281.863 15/ 4
FEB	TOTAL (MBTU) PEAK (KBTU) DY/HR	16.339 41.991 28/17	122.848 269.436 3/ 7
MAR	TOTAL (MBTU) PEAK (KBTU) DY/HR	17.935 41.991 31/17	109.717 230.686 4/ 6
APR	TOTAL (MBTU) PEAK (KBTU) DY/HR	16.753 63.093 24.366	49.647 193.118 5/ 6
MAY	TOTAL (MBTU) PEAK (KBTU) DY/HR	104.965 31/16 35.462	13.556 144.061 5/ 6
JUN	TOTAL (MBTU) PEAK (KBTU) DY/HR	119.661 19/10 42.855	0.000 0.000 30/ 1
JUL	TOTAL (MBTU) PEAK (KBTU) DY/HR	136.462 23/16 43.923	0.000 0.000 31/ 1
AUG	TOTAL (MBTU) PEAK (KBTU) DY/HR	132.895 21/10 29.077	0.000 0.000 31/ 1
SEP	TOTAL (MBTU) PEAK (KBTU) DY/HR	123.224 6/16 17.561	0.000 0.000 30/ 1
OCT	TOTAL (MBTU) PEAK (KBTU) DY/HR	63.506 1/17 17.132	44.215 203.598 20/ 6
NOV	TOTAL (MBTU) PEAK (KBTU) DY/HR	55.342 23/14 18.098	91.001 228.680 3/ 5
DEC	TOTAL (MBTU) PEAK (KBTU) DY/HR	41.991 31/17 297.602 136.462	139.052 260.580 13/ 8 717.952 281.863
	ONE YEAR USE/PEAK		

ENERGY TYPE	ELECTRICITY	NATURAL-GAS
IN SITE MBTU -		
CATEGORY OF USE		
SPACE HEAT	22.12	717.95
SPACE COOL	86.39	0.00
HVAC AUX	41.91	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	147.18	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	297.61	717.95

TOTAL SITE ENERGY 1015.55 MBTU 221.3 KBTU/SQFT-YR GROSS-AREA 221.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1611.65 MBTU 351.1 KBTU/SQFT-YR GROSS-AREA 351.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 17.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

APPENDIX E
COMPUTER SIMULATION PROGRAM

EZDOE - Commercial Building Energy Analysis (DOE): The EZDOE program is an easy to use IBM PC compatible version of the U.S. Department of Energy (DOE) program known as DOE-2.1. EZDOE calculates the hourly energy use of a building and its life cycle cost of operation given information on the building's location, construction, operation, and heating and air conditioning system. Using hourly weather data and algorithms developed by Lawrence Berkeley Laboratory, EZDOE is a dynamic program that takes into account complex thermal storage effects of various building materials. In addition, EZDOE can also accurately simulate the operation of all types of heating and cooling plants including ice water thermal storage and cogeneration systems. Up to 22 different air handling systems each with multiple control options are supported. The types of heating and cooling plants allowed is nearly infinite as thousands of combinations of chillers, boilers, furnaces, pumps, and cooling towers are allowed. There is even provision for user defined plants and performance curves.

EXECUTIVE SUMMARY

DOE-2 enables architects and engineers to compute energy consumption in buildings. The program can simulate hour-by-hour performance of a building for each of the 8760 hours in a year. A new computer language, the Building Description Language, has been written. It is a computer language for analysis of building energy consumption that permits the user to instruct a computer in familiar English terminology.

Building Description Language has been developed primarily to aid engineers and architects in the difficult and time-consuming task of designing energy-efficient buildings that have low life-cycle cost. The energy consumption of a building is determined by its shape; the thermal properties of materials; the size and position of walls, floors, roofs, windows, and doors; and the transient effects of shading, occupancy patterns, lighting schedules, equipment operation, ambient conditions, and temperature and humidity controls. Energy consumption is affected, also, by the operation of primary and secondary HVAC systems and by the type and efficiency of the fuel conversion (plant) equipment. Furthermore, the life-cycle cost of operating a building under different economic constraints can strongly influence basic design decisions.

DOE-2 also provides a means of performing the complicated analysis of energy consumption without the necessity of instructing the program correctly in every minor detail. A set of default values (numbers used for the value of a variable if the user does not assign one) is included, to reduce the amount of input that must be supplied in order to run the program.

BDL Processor

The BDL Processor sequentially checks each BDL instruction for proper form, syntax, and content. The BDL Processor also checks for values that are beyond the expected range for input variables. As stated before, if a value is not specified, the BDL processor assigns an assumed (default) value, which will appear in the listing of input data. Sometimes the default value is actually a set of default values, such as a performance curve for a piece of equipment. It is possible for the user to override this set of default values (performance curve) with a different set of default values. The BDL Processor also collects whatever data the user desires from the various permanent libraries, e.g., data from the Materials Library. Response factors, numbers that are used to determine the transient flow of heat through exterior walls and roofs as they react to randomly fluctuating climatic conditions, are also calculated by the BDL Processor for use by the LOADS and SYSTEMS programs. The BDL processor will calculate, if desired, Custom Weighting Factors and build user-designed libraries of materials and walls. These factors are intended to account for the thermal lag in the heating and cooling of furnishings and structures. The BDL Processor also prepares the input data files for use by the LOADS, SYSTEMS, PLANT, or ECONOMICS (LSPE) simulators.

It is important to recognize that each of the LSPE simulators depends on the results of some or all of the previous simulators, and that many variations and combinations are allowed. Each of the LSPE simulators can be run repeatedly, to study the effect of design variations. Superior energy-efficient building design can result in greatly reduced energy consumption and

significantly lower life-cycle cost.

LOADS Program

The LOADS program simulator calculates the hourly heating and cooling loads, using primarily the algorithms described in Ref. 1, "Procedure for Determining Heating and Cooling Loads for Computerizing Energy Calculations, Algorithms for Building Heat Transfer Subroutines," available from the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE). DOE-2 provides a reorganization and reprogramming of many of these algorithms to increase execution speed. A description of the BDL input for the LOADS program (LDL) is presented in Chap. III, and a detailed description of the LOADS simulator is given in the Engineers Manual.

In the LOADS program (simulator), the heat gains and losses through walls, roofs, floors, windows, and doors are calculated separately. Heat transfer by conduction and radiation through the building skin is computed, using response factors, considering the effects of the thermal mass, placement of insulation, sun angle, cloud cover, and building location, orientation, and architectural features. Every set of response factors generated is placed in a file to be used by the LOADS and SYSTEMS programs. Infiltration loads can be calculated on the basis of the difference between the inside and outside conditions and on an assumed leak rate (crack method) or by an air-change method.

Internal use of energy for lighting and equipment is also computed according to schedules assigned by the user for each piece of equipment that affects the energy balance of each space. The latent and sensible heat given off by the building occupants is calculated as an hour-by-hour function of the occupancy of the building.

All the LOADS computations are performed on the basis of a fixed temperature for each space as specified by the user. Because the LOADS program calculates thermal loads on the basis of hourly weather data but artificial (fixed) space temperatures, the output may have little bearing on the actual thermal requirements of a building. It is, instead, a baseline profile of the thermal performance of a space, given a fixed internal temperature. The SYSTEMS program then modifies the output of the LOADS program, to produce actual thermal loads based on a hourly variable internal temperature.

The output of LOADS is useful to architects who wish to examine the thermal behavior of various combinations of materials used to make up alternative exterior walls and roofs. However, it is expected that engineers will be interested in the predicted thermal demands on the physical plant (chillers and heaters), obtained by running both the LOADS and SYSTEMS programs.

SYSTEMS Program

The SYSTEMS program contains algorithms for simulating performance of the secondary HVAC equipment used to control the temperature and humidity of each zone within the building. Many of the equations used to develop the SYSTEMS simulation procedure are given in Refs. 1 and 2. These algorithms have been

organized and coded to allow selection of one of the preprogrammed space conditioning systems described in Chap. IV. The SYSTEMS program is used by choosing one of these preprogrammed systems and providing the necessary input data for the simulation calculations.

The SYSTEMS program uses the output information from the LOADS program and a list of user-defined system characteristics (e.g., air flow rates, thermostat settings, schedules of equipment operation, or temperature setback schedules) to calculate the hour-by-hour energy requirements of the secondary HVAC system. The SYSTEMS program calculates thermal loads based on variable temperature conditions for each zone.

PLANT Program

The PLANT program contains the equations necessary to calculate the performance of the primary energy conversion equipment. The operation of each plant component (e.g., boiler, absorption chiller, compression chiller, cooling tower, hot water storage tank, solar heater) is modeled on the basis of operating conditions and part-load performance characteristics. The user selects the type of plant equipment to be modeled (e.g., 2-stage absorption chiller), the size of each unit (e.g., 100 tons), the number of units, and the number of units simultaneously available. Values for equipment lifetime and maintenance may also be entered if preprogrammed values for these variables are not used. The sequence of equipment operation may be specified as a step function (e.g., from 0 to 500,000 Btu/hr, unit 1; from 500,001 to 10M Btu/hr, units 1 and 2). The user may schedule equipment operation by time (hourly or seasonally) or by peak load schedules. Additionally, the operating strategy between the various types of equipment may be specified. Energy storage may be specified. The PLANT program uses hourly results from the LOADS and SYSTEMS programs and the user's instructions to calculate the electrical and thermal energy consumption of the building. The DOE-2 PLANT program also contains subroutines for computing the life-cycle costs of plant equipment.

REPORT BEPS - ESTIMATED BUILDING ENERGY PERFORMANCE

The information in this report has been calculated and formatted to comply with the U.S. Department of Energy's Building Energy Performance Standards. The report makes it possible to review quickly the building performance as a function of site energy used (by type) per unit floor area. The breakdown of usage of up to five different types of energy sources is presented. These energy sources are user-specified through the ENERGY-COST and PLANT-PARAMETERS instructions.

HVAC auxiliary (shown as HVAC AUX) is defined as the energy required to operate non-solar fans, pumps, etc., which transport the conditioned air and water. AUX SOLAR is the energy required to operate the fans, pumps, etc., that transport the conditioned water or air associated with solar equipment. SPACE COOL and SPACE HEAT includes all equipment required to produce the conditioned water or air for SPACE heating or cooling.

Process and domestic hot water (shown as DOM HOT WTR) is the summation of the user input for hot water in the BUILDING-RESOURCE instruction and any entries for SOURCE-TYPE = HOT-WATER in the SPACE-CONDITIONS instruction.

Vertical transportation (shown as VERT TRANS) is the summary of energy for elevators and escalators input through the BUILDING-RESOURCE instruction.

Loads that are input through the SOURCE-TYPE = GAS or SOURCE-TYPE = ELECTRIC in the SPACE-CONDITIONS instruction will appear in this report as miscellaneous equipment (shown as MISC EQUIP). Loads entered as SOURCE-TYPE = PROCESS are assumed to have energy sources independent of the building utilities (i.e., wood stoves, acetylene welders, etc.) and are not reported in the BEPS report.

The distribution of ENERGY TYPE among the CATEGORY OF USE items is exact for every type of energy except electricity. Purchased electricity is apportioned correctly, but electricity generated on-site is apportioned on the basis of net yearly demands for electricity for each category.

It should also be pointed out that this report is not designed to work when there is a steam turbine among the specified plant equipment items. The numbers reported when a steam turbine is present will not be reliable.

The report of TOTAL SITE ENERGY and TOTAL SOURCE ENERGY provides a distinction between the energy used per gross square foot of building area and that used per net square foot of building area. The report generator takes the gross area from the keyword GROSS-AREA in the BUILDING-LOCATION instruction in LOADS. The default for this keyword is the net area, i.e., the sum of the floor areas of the CONDITIONED ZONES.

When a hot storage tank is present, a note is printed on the BEPS report stating that the hot water storage tank can get energy from many sources. Any time there is residual energy in the storage tanks, the totals in the BEPS report will not agree with those in report PS-B, because the BEPS report includes only the energy used for the above categories, whereas PS-B includes the energy that is left in the tanks as well.

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEV. JPMENT INC DOE-2.1D 2/27/1995 16:44:58 L RUN 1
 DENVER CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE EXAMPLE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	132.94	3450.29
SPACE COOL	427.44	0.00
→ HVAC AUX	267.62	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	612.35	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	511.11	0.00
TOTAL	1951.46	3450.29

TOTAL SITE ENERGY 5401.73 MBTU 1364.1 KBTU/SQFT-YR GROSS-AREA 387.0 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 9310.47 MBTU 2351.1 KBTU/SQFT-YR GROSS-AREA 667.0 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 17.0
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. E2DOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 11:34:22 PDL RUN 1
 DENVER CO 80227 PROPOSED MODIFICATION FOR BLDG #7612 ENL MEN BARRACKS W/O DIN
 REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	44.63	1274.67
SPACE COOL	433.49	0.00
→ HVAC AUX	254.78	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	612.35	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	511.10	0.00
TOTAL	1856.36	1274.67

TOTAL SITE ENERGY 3131.02 MBTU 74.8 KBTU/SQFT-YR GROSS-AREA 224.3 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 6849.30 MBTU 163.6 KBTU/SQFT-YR GROSS-AREA 490.7 KBTU/SQFT-YR NET-AREA
 PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 25.1
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.1
 NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
 ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

FEMP Project No. 1

Upgrade HVAC Systems in Dental Clinics
Buildings 602, 7665, and 7670

1. COMPONENT ARMY		FY 1995 MILITARY CONSTRUCTION PROJECT DATA			2. DATE MAY 95	
3. INSTALLATION AND LOCATION Fort Riley, Kansas				4. PROJECT TITLE Upgrade HVAC Systems in Dental Clinics		
5. PROGRAM ELEMENT		6. CATEGORY CODE		7. PROJECT NUMBER		8. PROJECT COST (\$000)
9. COST ESTIMATES						
ITEM				U/M	QUANTITY	COST (\$000)
Upgrade HVAC Systems in Dental Clinics				LS		79
TOTAL CONTRACT COST						79
SIOH (5.5%)						4
DESIGN COST (6.0%)						5
TOTAL PROJECT COST						88
Total Request (Rounded)						90
10. DESCRIPTION OF PROPOSED CONSTRUCTION The proposed construction consists of upgrading the HVAC systems in the dental clinics, Buildings 602, 7665, and 7670. The HVAC system upgrades include the following: <ul style="list-style-type: none"> Convert the existing dual duct air handling unit (AHU) serving Building 602 to a variable-air-volume (VAV) AHU. A variable speed drive (VSD) will be installed to control the supply fan speed. The existing dual duct mixing boxes will be replaced with dual duct VAV terminal units. The existing ductwork will remain. Convert the existing multizone AHU serving Building 7665 to a VAV AHU. A VSD will be installed to control the supply and return fan speed. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain. Convert the existing dual duct AHU serving Building 7670 to a VAV AHU. A VSD will be installed to control the supply and return fan speed. The existing dual duct mixing boxes will be replaced with dual duct VAV terminal units. The existing ductwork will remain. 						
11. REQUIREMENT: <u>Project:</u> This Federal Energy Management Program (FEMP) project will convert the existing dual duct and multizone AHUs to VAV AHUs in the dental clinics, Buildings 602, 7665, and 7670. <u>Requirement:</u> This project is required to reduce the natural gas and electrical consumption of the existing dual duct and multizone AHUs by reducing their air flow rates through VAV technology. An immediate utility savings would be recognized. <u>Current Situation:</u> The dental clinic buildings are single story buildings with the following floor areas and HVAC system types: <ul style="list-style-type: none"> Building 602 is a 11,560 sq ft building and is heated and cooled by a dual duct AHU. Building 7665 is a 11,080 sq ft building and is heated and cooled by a multizone AHU. Building 7670 is a 14,960 sq ft building and is heated and cooled by a dual duct AHU. 						

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95
3. INSTALLATION AND LOCATION Fort Riley, Kansas		
4. PROJECT TITLE Upgrade HVAC Systems in Dental Clinics		5. PROJECT NUMBER
<p>11. REQUIREMENT (continued):</p> <p>Impact if Not Provided: If this project is not funded, a reduction of 1,459 MBtu/yr (1,537,778 MJ/yr) cannot be achieved. The Army will not realize a \$23,779 annual energy dollar savings with a 3.7 year simple payback and a savings-to-investment ratio (SIR) of 4.22. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.</p> <p>Supporting Documentation: Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.</p> <p>Verification of Savings: The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.</p> <p>Amount of Energy Conserved: The amount of energy conserved is estimated to be 1,459 MBtu per year (1,537,778 MJ/yr).</p>		

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE:	Upgrade HVAC Systems in Dental Clinics		FISCAL YEAR: 1995
ANALYSIS DATE:	05/24/95	ECONOMIC LIFE: 20	PREPARED BY: A. Niemeyer

1. INVESTMENT: Dental Clinic Buildings 602, 7665, and 7670 - Convert DD AHUs and MZ AHU to VAV AHUs

A. CONSTRUCTION COST	=	\$78,841
B. SIOH COST	(5.5% of 1A) =	\$4,336
C. DESIGN COST	(6.0% of 1A) =	\$4,730
D. TOTAL COST	(1A + 1B + 1C) =	\$87,908
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$87,908

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COS \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	1,871	\$22,639	15.88	\$359,509
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(412)	(\$1,697)	18.30	(\$31,063)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. DEMAND (KW)			\$2,837	14.88	\$42,215
F. TOTAL		1,459	\$23,779		-----> \$370,660

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$0	5	0.863	\$0
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$0			\$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$23,779

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 3.70

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$370,660

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 4.22

(MUST HAVE SIR > 1.25 TO QUALIFY)

FEMP Project No. 2

Upgrade HVAC Systems in Dining Facilities
Buildings 7245, 7606, and 7654

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA			2. DATE MAY 95
3. INSTALLATION AND LOCATION Fort Riley, Kansas			4. PROJECT TITLE Upgrade HVAC Systems in Dining Facilities	
5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST (\$000)	
9. COST ESTIMATES				
ITEM	U/M	QUANTITY	UNIT COST	COST (\$000)
Upgrade HVAC Systems in Dining Facilities	LS			558
TOTAL CONTRACT COST				558
SIOH (5.5%)				31
DESIGN COST (6.0%)				33
TOTAL PROJECT COST				622
Total Request (Rounded)				625
<p>10. DESCRIPTION OF PROPOSED CONSTRUCTION The proposed construction consists of upgrading the HVAC systems in the dining facilities, Buildings 7245, 7606, and 7654. The HVAC system upgrades include the following:</p> <ul style="list-style-type: none"> • Replace existing single zone air handling units (AHUs) serving the dining areas with variable-air-volume (VAV) AHUs. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain. • Replace existing make-up air handling units (MAUs) serving the kitchen areas with heat recovery air handling units (HRUs). The exhaust fans interlocked with the MAUs will be removed. Exhaust air ductwork will be provided at the roof exhaust air outlets and connected to the inlets on the HRUs. • Replace the existing steam boiler serving both space heating and service water heating with separate boilers for each of the loads. An energy efficient hot water boiler will be installed for space heating. An energy efficient steam boiler will be installed for service water heating. <p>11. REQUIREMENT: Project: This Federal Energy Management Program (FEMP) project will replace the following HVAC systems in the dining facilities, Buildings 7245, 7606, and 7654:</p> <ul style="list-style-type: none"> • Replace the existing single zone AHUs with VAV AHUs • Replace the MAUs with HRUs • Replace the steam boiler serving both space and service water heating loads with separate boilers for each load. <p>Requirement: This project is required to reduce the natural gas and electrical energy consumption of the existing single zone AHUs by replacement with VAV AHUs, of the existing MAUs by replacement with HRUs, and of the existing steam boiler by replacement with smaller energy efficient boilers. An immediate utility savings would be recognized.</p> <p>Current Situation: The dining facilities are single story, 14,000 sq ft buildings with single zone AHUs serving the dining areas, MAUs serving the kitchen areas, and a large steam boiler serving the space heating and service water heating loads.</p>				

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95
3. INSTALLATION AND LOCATION Fort Riley, Kansas		
4. PROJECT TITLE Upgrade HVAC Systems in Dining Facilities		5. PROJECT NUMBER
<p>11. REQUIREMENT (continued):</p> <p>Impact if Not Provided: If this project is not funded, a reduction of 15,117 MBtu/yr (15,933,318 MJ/yr) cannot be achieved. The Army will not realize a \$71,100 annual energy dollar savings with a 6.65 year simple payback and a savings-to-investment ratio (SIR) of 2.66. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.</p> <p>Supporting Documentation: Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.</p> <p>Verification of Savings: The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.</p> <p>Amount of Energy Conserved: The amount of energy conserved is estimated to be 15,117 MBtu per year (15,933,318 MJ/yr).</p>		

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Upgrade HVAC Systems in Dining Facilities		FISCAL YEAR: 1995
ANALYSIS DATE: 05/24/95	ECONOMIC LIFE: 20	PREPARED BY: A. Niemeyer

1. INVESTMENT: Dining Facilities Buildings 7245, 7606, and 7654 - Replace SZ AHUs with VAV AHUs;

Replace MAUs with HRUs; Replace Large Steam Boiler with Smaller HW Boiler and Steam Boiler

A. CONSTRUCTION COST	=	\$558,179
B. SIOH COST	(5.5% of 1A) =	\$30,700
C. DESIGN COST	(6.0% of 1A) =	\$33,491
D. TOTAL COST	(1A + 1B + 1C) =	\$622,370
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$622,370

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COS \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	837	\$10,128	15.88	\$160,828
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	14,280	\$58,834	18.30	\$1,076,655
D. COAL	\$0.00	0	\$0	16.62	\$0
E. DEMAND (KW)			\$2,139	14.88	\$31,828
F. TOTAL		15,117	\$71,100		-----> \$1,269,311

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	(\$543)	14.88	(\$8,080)
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	(\$543)		(\$8,080)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$460,107	5	0.863	\$397,072
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$460,107			\$397,072

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)	(3A4 + 3Bf4) =	\$388,993
--	----------------	-----------

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3 + 3A4 + (3Bf1/Economic Life))	\$93,563
--	------------------------------------	----------

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	6.65
--	----------	------

6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	\$1,658,304
---------------------------------	--------------	-------------

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.66
--	----------	------

FEMP Project No. 3

Upgrade HVAC Systems in Indoor Swimming Pools
Buildings 6940 and 8069

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA			2. DATE MAY 95	
3. INSTALLATION AND LOCATION Fort Riley, Kansas			4. PROJECT TITLE Upgrade HVAC Systems in Indoor Swimming Pool Buildings		
5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST (\$000)		
9. COST ESTIMATES					
ITEM		U/M	QUANTITY	UNIT COST	COST (\$000)
Upgrade HVAC Systems in Indoor Swimming Pool Buildings		LS			335
TOTAL CONTRACT COST					335
SIOH (5.5%)					18
DESIGN COST (6.0%)					20
TOTAL PROJECT COST					373
Total Request (Rounded)					375
<p>10. DESCRIPTION OF PROPOSED CONSTRUCTION</p> <p>The proposed construction consists of upgrading the HVAC systems in the indoor swimming pools, Buildings 6940 and 8069. The HVAC system upgrades include the following:</p> <ul style="list-style-type: none"> Replace the existing heating and ventilating unit (H&V) serving the swimming pool area of Building 6940 with a heat recovery air handling unit (HRU). Exhaust ductwork will be installed to exhaust the air out through the roof. A roof outlet will be installed for the exhaust air. The existing outside air ductwork will remain. Replace four existing H&Vs serving the swimming pool area of Building 8069 with two HRUs. Exhaust ductwork will be installed to exhaust the air out through the roof. A roof outlet will be installed for the exhaust air. The existing outside air ductwork will remain. <p>11. REQUIREMENT:</p> <p>Project: This Federal Energy Management Program (FEMP) project will replace the existing H&Vs with HRUs in the indoor swimming pools, Buildings 6940 and 8069.</p> <p>Requirement: This project is required to reduce the natural gas and electrical consumption by replacement of the existing H&Vs with HRUs. An immediate utility savings would be recognized.</p> <p>Current Situation: The indoor swimming pool, Building 6940, is a 23,450 sq ft single story building with the pool area heated and ventilated by a H&V. The indoor swimming pool and gymnasium, Building 8069, is a 25,620 sq ft two story building with the pool area heated and ventilated by four H&Vs.</p>					

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95
3. INSTALLATION AND LOCATION Fort Riley, Kansas		
4. PROJECT TITLE Upgrade HVAC Systems in Indoor Swimming Pool Buildings		5. PROJECT NUMBER
<p>11. REQUIREMENT (continued):</p> <p>Impact if Not Provided: If this project is not funded, a reduction of 11,951 MBtu/yr (12,596,354 MJ/yr) cannot be achieved. The Army will not realize a \$57,226 annual energy dollar savings with a 6.32 year simple payback and a savings-to-investment ratio (SIR) of 2.81. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.</p> <p>Supporting Documentation: Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.</p> <p>Verification of Savings: The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.</p> <p>Amount of Energy Conserved: The amount of energy conserved is estimated to be 11,951 MBtu per year (12,596,354 MJ/yr).</p>		

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Upgrade HVAC Systems in Indoor Swimming Pools		FISCAL YEAR: 1995
ANALYSIS DATE: 05/24/95	ECONOMIC LIFE: 20	PREPARED BY: A. Niemeyer

1. INVESTMENT: Indoor Swimming Pools in Buildings 6940 and 8069 - Replace existing H&Vs with HRUs

A. CONSTRUCTION COST	=	\$334,555
B. SIOH COST	(5.5% of 1A) =	\$18,401
C. DESIGN COST	(6.0% of 1A) =	\$20,073
D. TOTAL COST	(1A + 1B + 1C) =	\$373,029
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$373,029

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COS \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	1,001	\$12,112	15.88	\$192,340
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	10,950	\$45,114	18.30	\$825,586
D. COAL	\$0.00	0	\$0	16.62	\$0
E. DEMAND (KW)			\$0	14.88	\$0
F. TOTAL		11,951	\$57,226		-----> \$1,017,926

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$35,706	5	0.863	\$30,814
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$35,706			\$30,814

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$30,814

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$59,011

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 6.32

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$1,048,741

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 2.81

(MUST HAVE SIR > 1.25 TO QUALIFY)

FEMP Project No. 4

Upgrade HVAC Systems in Bowling Alley and Community
Activities Center

Bowling Alley - Building 7485
Community Activities Center - Building 6620

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA			2. DATE MAY 95	
3. INSTALLATION AND LOCATION Fort Riley, Kansas			4. PROJECT TITLE Upgrade HVAC Systems in Bowling Alley and Community Activities Center		
5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST (\$000)		
9. COST ESTIMATES					
ITEM	U/M	QUANTITY	UNIT COST	COST (\$000)	
Upgrade HVAC Systems in Bowling Alley and Community Activities Center	LS			67	
TOTAL CONTRACT COST				67	
SIOH (5.5%)				4	
DESIGN COST (6.0%)				4	
TOTAL PROJECT COST				75	
Total Request (Rounded)				80	
10. DESCRIPTION OF PROPOSED CONSTRUCTION The proposed construction consists of upgrading the HVAC systems in the Bowling Alley, Building 7485 and the Community Activities Center, Building 6620. The HVAC system upgrades include the following: <ul style="list-style-type: none"> Convert the existing dual duct air handling unit (AHU) serving Building 7485 to a variable-air-volume (VAV) AHU. A variable speed drive (VSD) will be installed to control the supply fan speed. The existing dual duct mixing boxes will be replaced with dual duct VAV terminal units. The existing ductwork will remain. In Building 6620, replace two existing single zone air handling units (AHUs) serving the ballroom and the dining room with VAV AHUs. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain. Convert the existing multizone AHU serving Building 6620 to a VAV AHU. A VSD will be installed to control the supply fan speed. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain. 					
11. REQUIREMENT: <u>Project:</u> This Federal Energy Management Program (FEMP) project will convert the existing dual duct AHU in Building 7485 to a dual duct VAV AHU. This project will also replace the existing single zone AHUs in Building 6620 with VAV AHUs and convert the existing multizone AHU to a VAV AHU. <u>Requirement:</u> This project is required to reduce natural gas and electrical energy consumption by replacement of existing single zone AHUs with VAV AHUs, by conversion of a dual duct AHU to a dual duct VAV AHU, and by conversion of a multizone AHU to a VAV AHU. An immediate utility savings would be recognized. <u>Current Situation:</u> The Bowling Alley, Building 7485, is a 36,970 sq ft single story building with the bowling lanes heated and cooled by a dual duct AHU. The Community Activities Center, Building 6620, is a 31,740 sq ft two story building with the ballroom and dining room heated and cooled by single zone AHUs, and an office administration area heated and cooled by a multizone AHU.					

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95
3. INSTALLATION AND LOCATION Fort Riley, Kansas		
4. PROJECT TITLE Upgrade HVAC Systems in Bowling Alley and Community Activities Center		5. PROJECT NUMBER
<p>11. REQUIREMENT (continued):</p> <p>Impact if Not Provided: If this project is not funded, a reduction of 1,039 MBtu/yr (1,095,106 MJ/yr) cannot be achieved. The Army will not realize a \$14,661 annual energy dollar savings with a 4.65 year simple payback and a savings-to-investment ratio (SIR) of 3.41. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.</p> <p>Supporting Documentation: Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.</p> <p>Verification of Savings: The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.</p> <p>Amount of Energy Conserved: The amount of energy conserved is estimated to be 1,039 MBtu per year (1,095,106 MJ/yr).</p>		

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION: Fort Riley	REGION: 2 (Kansas)	PROJECT NO: 1406-005
PROJECT TITLE: Upgrade HVAC Systems in Bowling Alley and Comm Act Cntr		FISCAL YEAR: 1995
ANALYSIS DATE: 05/24/95	ECONOMIC LIFE: 20	PREPARED BY: A. Niemeyer

Building 7485 - Convert existing DD AHU to a DD VAV AHU; Building 6620 - Replace existing

1. INVESTMENT: Building 6620 - Replace existing SZ AHUs with VAV AHUs, and Convert existing MZ AHU to a VAV AHU

A. CONSTRUCTION COST	=	\$67,449
B. SIOH COST	(5.5% of 1A) =	\$3,710
C. DESIGN COST	(6.0% of 1A) =	\$4,047
D. TOTAL COST	(1A + 1B + 1C) =	\$75,206
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$75,206

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COS \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	1,142	\$13,818	15.88	\$219,433
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	(103)	(\$424)	18.30	(\$7,766)
D. COAL	\$0.00	0	\$0	16.62	\$0
E. DEMAND (KW)			\$1,267	14.88	\$18,853
F. TOTAL		1,039	\$14,661		-----> \$230,520

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
1 ANNUAL MAINTENANCE	\$0	14.88	\$0
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$0		\$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	\$30,326	5	0.863	\$26,171
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$30,326			\$26,171

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$26,171

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$16,177

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 4.65

6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$256,692

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 3.41

(MUST HAVE SIR > 1.25 TO QUALIFY)

FEMP Project No. 5

Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool
Admin, and Battalion Headquarters

Fire Station - Building 5000

Unit Chapel - Building 7086

Motor Pool Admin - Building 7178

Battalion Headquarters - Building 7806

1. COMPONENT ARMY		FY 1995 MILITARY CONSTRUCTION PROJECT DATA			2. DATE MAY 95	
3. INSTALLATION AND LOCATION Fort Riley, Kansas				4. PROJECT TITLE Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin and Battalion Headquarters		
5. PROGRAM ELEMENT		6. CATEGORY CODE		7. PROJECT NUMBER		8. PROJECT COST (\$000)
9. COST ESTIMATES						
ITEM				U/M	QUANTITY	COST (\$000)
Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin, and Battalion Headquarters				LS		97
TOTAL CONTRACT COST						97
SIOH (5.5%)						5
DESIGN COST (6.0%)						6
TOTAL PROJECT COST						108
Total Request (Rounded)						110
<p>10. DESCRIPTION OF PROPOSED CONSTRUCTION</p> <p>The proposed construction consists of upgrading the HVAC systems in the Fire Station - Building 5000, the Unit Chapel - Building 7086, the Motor Pool Admin - Building 7178, and the Battalion Headquarters - Building 7806. The HVAC system upgrades include the following:</p> <ul style="list-style-type: none"> Replace the existing multizone air handling unit (AHU) serving Building 5000 with three furnace air conditioning units (FACs). The supply air ductwork will be modified to serve three zones instead of the existing five zones. The existing air cooled condensing unit (ACCU) will be replaced with three ACCUs each serving the FACs. The existing boiler will be replaced with a smaller modular HW boiler, and will serve the heating and ventilating unit only. Replace the existing single zone AHU serving Building 7086 with a variable-air-volume (VAV) AHU. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain. Replace three existing window air conditioners (WACs) serving Building 7178 with a single zone AHU. Supply air ductwork with supply grilles will be installed. An ACCU will be installed to provide cooling to the single zone AHU. Replace two existing single zone AHUs serving Building 7806 with VAV AHUs. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain. <p>11. REQUIREMENT:</p> <p>Project: This Federal Energy Management Program (FEMP) project will replace the existing multizone AHU in Building 5000 with three FACs. Also in Building 5000, the existing ACCU will be replaced with three smaller ACCUs, and the HW boiler will be replaced with a smaller HW boiler. This project will also replace the existing single zone AHU in Building 7086 with a VAV AHU; replace three WACs with a single zone AHU and an ACCU in Building 7178; and replace two single zone AHUs with VAV AHUs in Building 7806.</p>						

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95
3. INSTALLATION AND LOCATION Fort Riley, Kansas		
4. PROJECT TITLE Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin and Battalion Headquarters		5. PROJECT NUMBER
<p>11. REQUIREMENT (continued):</p> <p>Requirement: This project is required to reduce natural gas and electrical energy consumption by replacement of a multizone AHU with three FACs; by replacement of an existing ACCU with three smaller ACCUs and an existing HW boiler with a smaller modular HW boiler; by replacement of three WACs with a single zone AHU and ACCU; and by replacment of existing single zone AHUs with VAV AHUs. An immediate utility savings would be recognized.</p> <p>Current Situation: The Fire Station, Building 5000, is a 8,400 sq ft single story building with the quarters and communication center heated and cooled by a multizone AHU. The Unit Chapel, Building 7086, is a 8,700 sq ft single story building with the church sanctuary heated and cooled by a single zone AHU. The Motor Pool Admin, Building 7178, is a 2,480 sq ft single story building cooled by three WACs. The Battalion Headquarters, Building 7806 is a 13,490 sq ft single story building heated and cooled by two single zone AHUs.</p> <p>Impact if Not Provided: If this project is not funded, a reduction of 712 MBtu/yr (750,448 MJ/yr) cannot be achieved. The Army will not realize a \$8,533 annual energy dollar savings with a 7.36 year simple payback and a savings-to-investment ratio (SIR) of 2.23. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.</p> <p>Supporting Documentation: Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.</p> <p>Verification of Savings: The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.</p> <p>Amount of Energy Conserved: The amount of energy conserved is estimated to be 712 MBtu per year (750,448 MJ/yr).</p>		

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION: Fort Riley REGION: 2 (Kansas) PROJECT NO: 1406-005
 PROJECT TITLE: Upgrade HVAC Sys in Fire Stn, Chpl, Mtr Pl Admin, and Bn HQ FISCAL YEAR: 1995
 ANALYSIS DATE: 05/24/95 ECONOMIC LIFE: 20 PREPARED BY: A. Niemeyer

**Building 5000 - Replace existing MZ AHU with FACs, also replace ACCU with three smaller ACCUs
 and replace HW boiler with smaller modular HW boiler;**

Building 7086 - Replace SZ AHU with VAV AHU;

Building 7178 - Replace three WACs with SZ AHU and ACCU;

Building 7806 - Replace SZ AHUs with VAV AHUs

1. INVESTMENT:

A. CONSTRUCTION COST	=	\$96,904
B. SIOH COST	(5.5% of 1A) =	\$5,330
C. DESIGN COST	(6.0% of 1A) =	\$5,814
D. TOTAL COST	(1A + 1B + 1C) =	\$108,048
E. SALVAGE VALUE OF EXISTING EQUIPMENT	=	\$0
F. PUBLIC UTILITY COMPANY REBATE	=	\$0
G. TOTAL INVESTMENT	(1D - 1E - 1F) =	-----> \$108,048

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS:

JAN '95

ENERGY SOURCE	FUEL COS \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT.	\$12.10	489	\$5,917	15.88	\$93,960
B. DIST	\$0.00	0	\$0	19.16	\$0
C. NAT GAS	\$4.12	223	\$919	18.30	\$16,813
D. COAL	\$0.00	0	\$0	16.62	\$0
E. DEMAND (KW)			\$1,697	14.88	\$25,251
F. TOTAL		712	\$8,533		-----> \$136,025

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	\$511	14.88	\$7,604
2	\$0	14.88	\$0
3	\$0	14.88	\$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	\$511		\$7,604

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS/COST (4)
(TABLE A-2)				
a. BASELINE EQUIP. REPLCMNT.	\$112,934	5	0.863	\$97,462
b.				\$0
c.				\$0
d.				\$0
e.				\$0
f. TOTAL	\$112,934			\$97,462

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = \$105,066

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A4 + (3Bf1/Economic Life)) \$14,690
 5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 7.36
 6. TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$241,091
 7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 2.23
 (MUST HAVE SIR > 1.25 TO QUALIFY)